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Popular Science

FOUNDED MONTHLY



New Ideas for Motorcycle Comfort (See page 42)
ARCH Most Wonderfully Illustrated Magazine in the World 25 CENTS



For permanence and beauty



To prevent its beauty



To "show" your roof



To "show" your roof



For better appearance



To retain value



To save your money



To keep attractive

CONDENSED HOUSEHOLD GUIDE

For Painting, Varnishing, Staining and Enameling
IMPORTANT: Each of the products specified below bears our name and trade mark



SURFACE	TO PAINT— USE PRODUCT NAMED BELOW	TO VARNISH— USE PRODUCT NAMED BELOW	TO STAIN— USE PRODUCT NAMED BELOW	TO ENAMEL— USE PRODUCT NAMED BELOW
AUTOMOBILES	S-W Auto Enamel	S-W Auto Enamel Clear		S-W Auto Enamel
AUTOMOBILE TOPS AND SEATS	S-W Auto Top and S-W Auto Seat Dressing			
BRICK	SWP House Paint S-W Concrete Wall Finish			Old Dutch Enamel
CEILING, Interior	Flat-Tone	Scar-Not Varnish	S-W Handcraft Stain Floorlac	Enameloid
Exterior	SWP House Paint	Respar Varnish	S-W Oil Stain	Old Dutch Enamel
CONCRETE	S-W Concrete Wall Finish			
DOORS, Interior	SWP House Paint	Scar-Not Varnish Velvet Finish No. 1044	Floorlac S-W Handcraft Stain	Enameloid
Exterior	SWP House Paint	Respar Varnish	S-W Oil Stain	Old Dutch Enamel
FENCES	SWP House Paint Metalastic S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
FLOORS, Interior (wood)	S-W Inside Floor Paint	Mar-Not Varnish	Floorlac	S-W Inside Floor Paint
Concrete	S-W Concrete Floor Finish			S-W Concrete Floor Finish
Porch	S-W Porch and Deck Paint			
FURNITURE, Interior	Enameloid	Scar-Not Varnish	Floorlac	Old Dutch Enamel Enameloid
Porch	Enameloid	Respar Varnish	S-W Oil Stain	Old Dutch Enamel
HOUSE OR GARAGE Exterior	SWP House Paint	Respar Varnish	S-W Preservative Shingle Stain	Old Dutch Enamel
LINOLEUM	S-W Inside Floor Paint	Mar-Not Varnish		S-W Inside Floor Paint
RADIATORS	Flat-Tone S-W Aluminum or Gold Paint			Enameloid
ROOFS, Shingle	S-W Roof and Bridge Paint		S-W Preservative Shingle Stain	
Metal Composition	Metalastic Enamel			
SCREENS	S-W Screen Enamel			S-W Screen Enamel
TOYS	S-W Family Paint	Respar Varnish	Floorlac	Enameloid
WALLS, Interior (Plaster or Wallboard)	Flat-Tone SWP House Paint			Old Dutch Enamel Enameloid
WICKER	Enameloid	Respar Varnish	Floorlac	Old Dutch Enamel
WOODWORK Interior	SWP House Paint Flat-Tone	Scar-Not Varnish Velvet Finish No. 1044	S-W Handcraft Stain S-W Oil Stain Floorlac	Old Dutch Enamel Enameloid

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NOTE: Best results can be had by following the carefully prepared directions on labels.

SHERWIN-WILLIAMS
PAINTS AND VARNISHES

KEEP THIS PAGE

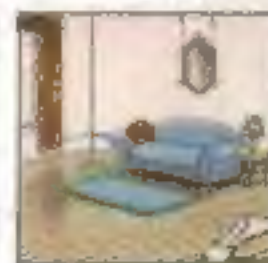
Have it handy for reference. It tells the exactly correct paint, varnish, stain or enamel for successful work throughout your home.

Write for free booklet B 450 with complete Household Guide and helpful information on all painting, varnishing, staining and enameling. Valuable whether you do the work yourself or employ a master painter.

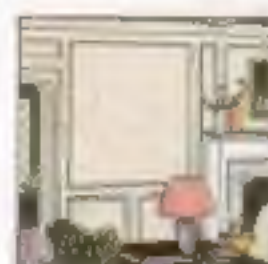
The "Guide" covers the more common problems. If you have some finishing problems not covered by the "Guide," write us. It will pay you to visit the nearest Sherwin-Williams dealer and consult the more extensive "Guide" shown in his store.

Send 50c (65c in Canada) for Home Painting Manual, 177 pages, handsome full color plates. Most complete book on the subject ever published. Address Dept. B, 435

THE SHERWIN-WILLIAMS CO., 659 Canal Rd., Cleveland, O.



To finish hard wood



For cheerful, attractive walls



To keep indoors like new



For stucco



To preserve finish woodwork



For long-lasting radiators



To make tires "new"



To withstand the weather

The COURT JESTER of TODAY

"No wit to flatter left of all his store,
No fool to laugh at, which he valued more."
—Pope

SINCE the earliest days, laughter and gaiety have been the most sought after things in life. In ancient times stately rulers unbent, courtly knights forgot seriousness; beautiful ladies became more alluring as the clever quips and merry pranks of the court jester brought a sparkle to their eyes and drove dull care away. But they were limited to the clownish antics and slapstick comedy of the jester.

Moderns have unlimited sources of amusement. Every broadcasting station has its Jester; its humorous stories; amusing songs and clever comedies. Each night the air is filled with merriment.

With a Crosley Model X-J radio receiver, amusement may be brought clearly and distinctly to your fireside. Sitting comfortably in an easy chair you forget dull care. The magic wand of the radio sends worry scurrying.

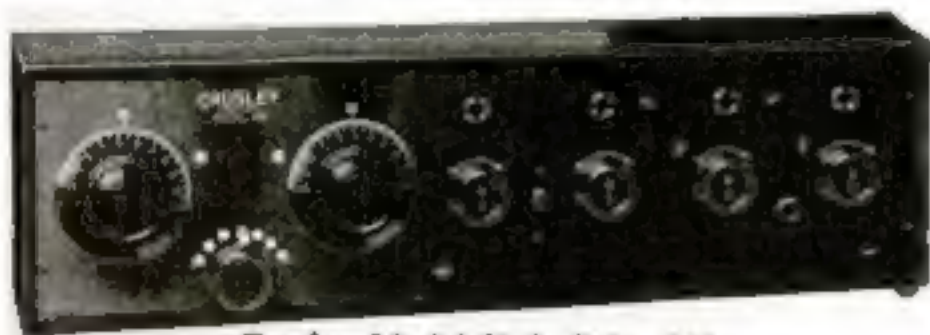
The very moderate prices of all Crosley instruments bring radio within the reach of all. No matter which Crosley Model you may select you can be assured of the maximum results at the lowest cost.

Let a Crosley Radio Receiver bring fun, laughter and good humor into your home.

CROSLEY Better-Cost Less Radio Products

See the Crosley Line at Good Dealers Everywhere

Write for Free Catalog. This fully describes the Crosley line of Radio receivers which range in price from the Model V1, a 2 tube set at \$30, to the graceful Console Model X-L at \$140. It also shows the complete line of Crosley parts.



Crosley Model X-J—Price \$65

For tuning out local interference and bringing in distant stations this receiver is unexcelled. It is a 4 tube set combining one stage of tuned radio frequency amplification, detector and two stages of audio frequency amplification. For bringing in distant stations no set can excel it. Cost of necessary accessories \$40.00 and up.

THE CROSLEY RADIO CORPORATION

Paul Crosley Jr., President

Formerly called the Precision Equipment Company and
Crosley Manufacturing Company

317 Alfred Street

Cincinnati, Ohio

The Largest Manufacturers of Radio Receivers in the World



CROSLEY \$
Model X-J 65

CROSLEY MANUFACTURING COMPANY Owns and
Operates Broadcasting Station WLW

MAIL THIS COUPON TODAY

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317 Alfred St., Cincinnati, O.

Gentlemen: Please mail me free of charge your complete catalog of Crosley instruments and parts.

Name.....

Address.....

POPULAR SCIENCE MONTHLY

Most Wonderfully Illustrated Magazine in the World

MARCH, 1924; Vol. 104, No. 3
25 cents a Copy; \$2.50 a Year



Published in New York City at
225 West Thirty-ninth Street

SCIENCE constantly is providing us with new thrills—new drama. Consider the proposed flight of the *Shenandoah* to the North Pole, of which Fitzhugh Green writes on page 31 of this issue.

Such a flight may prove the greatest venture into the unknown since the voyage of Columbus. When attempted, it will open up a whole new chapter in arctic exploration. It is a project made possible by the gifts of science and the unselfish labor of scientists.

THE flight itself is conceived for scientific purposes—to add to man's common knowledge of the world in which we live. Gold, oil, coal, a new continent—all are possible discoveries. And who knows but from this hazardous expedition may come some rare element, such as radium, that will revolutionize our lives?

ON PAGE 37 Dr. James J. Walsh, able scientist, tells of discoveries in the mind that transcend the discoveries of science in metals and minerals, steam and electricity, chemistry and physics. In his stimulating article he points out how we can shape our habits for good or bad—for health, success, and happiness, or for failure, misery, and disappointment.

AS YOU read his story, remember that the discoveries of science in the human mind are only beginning and are filled with enthusiastic expectations. Just as mineralogists are discovering new metals stored in the earth, psychologists, prospecting in the mind, are disclosing new and unsuspected mental and physical resources. One day psychology may show men how to transmit thoughts without words and without signs—by mental telepathy.

SCIENCE has harnessed and directed the elements and has produced thousands of

wonderful machines to help us with our daily labors. More recently science has begun to pay attention to man's body. As a result, the life expectancy of the average man—yours and mine—has been lengthened a dozen years. On page 34 is a fascinating story of the experiments of Dr. E. V. McCollum in the influence of food upon bodily welfare. And on page 43 is Dr.

Reynold A. Spaeth's story of the search of science to determine and overcome the causes of human fatigue.

WHAT about your physiological capital? A commercial credit man may take stock of you financially and find you have a comfortable reserve. But have you a comfortable physiological reserve? Or would a physiologist find that you are drawing on your reserve without replacements and are headed for physical bankruptcy?

IF YOU would reflect on the progress of science, turn to Captain Frank Hurley's thrilling narrative of exploration on page 40. Notice the awe with which the cannibals of New Guinea regarded the first airplane they ever had seen. Then read Mr. W. K. Kellogg's intensely

personal story of his unusual automobile, page 49, the delightful account of Maude Adams' surprising success as an inventor of daylight color projection of motion pictures, page 45, and Jack Binns' article on secret and directional radio, page 71. And as you marvel at these modern agencies of communication, travel, and entertainment, remember that men are yet young who saw the first airplane, the first automobile, and the first radio set.

THE possibilities in science for the future are boundless. The next generation may use bottled sunlight for light and heat, produce its food chemically, and employ atomic energy to drive the engines of industry.

In Next Month's Issue

Are You Planning a Home?—Phil Madison Riley, one of America's foremost writers on popular architecture, begins a series of fascinating adventures in home buying, building, and equipping.

The Headache Alarm—An able physician tells where head pains come from and why they are useful in warning us of defects in our machinery.

Radio Satisfaction—Jack Binns, American ace of radio writers, describes how to get maximum efficiency out of your receiving set.

"Black Flour"—An amazing account of the world's newest fuel—coal that can be piped, like gas, to the consumer.

And 200 other fascinating articles and pictures

POPULAR SCIENCE MONTHLY

Issued monthly. Single copy, 25 cents. Yearly subscription to United States, its possessions, and Canada, \$2.50; foreign countries, \$3.

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The contents of this magazine must not be reprinted without permission. H. J. Fisher, President; R. C. Wilson, Vice-President; O. B. Capen, Secretary and Treasurer

**Earned
\$25
a week**



**Now Has
Fine Home**



**Money
in the Bank**



**and His
Own Car**



**Earning Over
\$9000
a Year**

**Unlimited
Possibilities**

*for making
much more*

Can Success Like This Be An Accident?

"THE fellows who used to work with me while I was plugging along at \$25 a week are convinced that I either had a 'pull' or just 'fell into a good thing'—that my \$9,000 a year position is a sheer accident.

"When I told them I had found an easy way to earn big money as a salesman, they laughed at me and called it a 'hare-brained idea.' They told me 'salesmen are born, not made.' But I decided to see my harebrained idea 'through.' I was sick of slaving for a pittance.

"I started studying the secrets of master salesmanship as taught by the National Salesmen's Training Association—and almost before I knew it I had confidence to tackle my first selling position. And why not? I had mastered the very secrets of selling used by the most successful salesmen.

"My earnings during the past month were \$750. I now have better than a \$9,000 a year position—with lots more room to grow. I can state positively that my sudden success was not an accident. It came because I knew how to sell scientifically. And how simple it is to sell when you know how. My regret is that I did not know these secrets ten years ago."—Ellis Sumner Cook, Manufacturers Agent, 20 E. Jackson Blvd., Chicago, Ill.

Why Not Make More Money?

If you want to get out of the wage-earning class, if you want to make good money without loss of time—then do as Mr. Cook and thousands of others have done.

The secrets of salesmanship which Mr. Cook learned are available to you. There are certain ways to approach prospects, to stimulate interest, to overcome objections, and to close sales. Every move in selling is governed by certain rules. Once you know these success is yours.

Success Like This Yours

Adam Horneber, Bay City, Mich., writes: "I have increased my earning power 500 per cent since I secured your training in the Science of Selling."

Lewis A. Tines, Minneapolis, Minn., writes: "When I finished your training I left my job at \$160 a month and took a job as salesman. The first month I made over \$600 and I expect to go higher yet."

N. D. Miller, 1703 S. Clark Street, Chicago, says: "I place the credit for my success where it rightfully belongs. I owe my present position wholly to the N. S. T. A. In July, 1919, I studied your selling secrets and in September you secured me the position which I now hold. I am earning in excess of \$100 a week."

Employers

Are invited to write to the Employment Dept. of the N. S. T. A. We can put you in touch with just the men you need. No charge for this service to you or our members. Employers are also cordially invited to request details about the N. S. T. A. Group Plan of instruction for entire sales forces. Synopses and charts sent without obligation.



Bear in mind that these stories of real success—the kind that is waiting you in this field of unlimited money-making opportunities—are but a few of thousands on file. You will find scores of them in our literature.

Valuable Book Free

No matter what you may now think, it is only a thought. Get the facts! See for yourself how you can easily duplicate any of these stories of success. NOW and no other time is the minute to mail the coupon below. Our big free book, "Modern Salesmanship," will be mailed promptly. And there's no obligation.

NATIONAL SALESMEN'S TRAINING ASSOCIATION

Dept. 15-C, 53 W. Jackson Blvd.,
CHICAGO, ILL.



National Salesmen's Training Association
Dept. 15-C, 53 W. Jackson Blvd., Chicago, Ill.
Send me FREE your book "Modern Salesmanship,"
and proof that I can become a master salesman.

Name.....

Address.....

City..... State.....

Age..... Occupation.....

He Doesn't Know It Yet But He's a \$6,000 Man

"DO YOU SEE that earnest-looking fellow talking to the President?"

—It was the General Manager speaking; he and his guest were taking a turn thru the main offices.

—"That's the man I've got picked to take Short's place, as Auditor of the Company, when Short goes East. I've had my eye on him for more than a year; he's the kind of fellow who's bound to get ahead. I learned the other day that he has been studying evenings at home for the past six or eight months. He's one of the few men who really seem awake to their opportunities. A fellow like that is too good to lose, and we're going to make it worth his while to stick. He doesn't know it yet, but he's a six-thousand-dollar man!"

"Studying evenings—working out problems—taking an interest in the business"—if the men in subordinate positions could only read the minds of the men directing them, what surprising things they would learn about themselves!

—How every day, for example, those who show promise are being appraised for bigger jobs. —How their capacity is constantly being measured by the readiness with which they grasp the larger problems of the business. —How they are being gauged by the foresight they show in preparing for greater responsibilities.

For, after all, the extent to which a man is willing to prepare for bigger things is a mighty good index to his fitness to control them— isn't it?

The boss, you see—if he is a real executive and not a figurehead—put in many years equipping himself for his present position. Is it likely that he will overlook the chap who shows the same habits and tendencies which helped him to get ahead?

Then, too, when a man undertakes home-study training, he proves that he has good common-sense—and that's an asset!

For consider the logic of his undertaking—

For a comparatively few months—a year or two, at most—a man agrees with himself to give up a certain proportion of his "good times." He weighs them against his ambition to increase his income, and he deliberately chooses the bigger salary, the larger future. He knows that training is what he needs, and he values his self-respect so highly that he cannot be happy to drift any longer.



The point to all this is very simple. In making a decision of this kind, he is demonstrating his ability to discriminate between the values that are worth while and those that are no values at all. And inevitably that kind of shrewdness makes a real hit with sound business men.

He Learns by Solving Problems—and It's a Fascinating Method

But there's another phase to home-study training which we have neglected to mention.

While it takes courage to map out a course for oneself and to make the start, it is only a short time after one has got under way when it becomes no task at all, and instead of regarding his studies as a burden, a man gets to really looking forward to his periods of training. Under

the LaSalle Problem Method, he works with actual business problems, and they fascinate him. He is conscious that he is growing in business power. He sees the results of his increased ability in the promotions that he gains.

Consider, for example, such simple statements as the following, all susceptible to ready proof:

"Salary and earnings have increased over 183 per cent. Your course has given me the position I wished for, the salary I looked for, and has broadened my knowledge and vision so that I have perfect confidence in my ability to do any job in the accounting field."
FRANK B. TRISCO, Minnesota.

"Instead of a factory storekeeper, I find myself at the end of three years head of a department, with an increase in salary of 230 per cent."
F. H. LAWSON, California.

"Led the list in the Maine bar examination."
GORDON F. GALLERT, Maine.

"From a salesman in the ranks, in two short months my sales have shot up nearly 150 per cent. I am now a district manager, with eleven men working under me."
C. RUTHERFORD, Canada.

"—a total of 90 per cent increase in salary in two years. I saw this promotion in advance and was preparing myself for it, altho it came six months sooner than expected, which goes to show that it pays to be prepared."
R. L. KEEVES, Alabama.

Make Yourself a \$6,000 Man

Of course no amount of WISHING can get a man out of a mediocre place and put him on the right road to success.

But what astounding things a man can do if he changes his wishing to WILLING—if he really sets up a goal for himself and steadily bends his energies toward REACHING it!

What is YOUR goal? Is it symbolized by one or more of the courses listed on the coupon just below?

Then, for the sake of your future, take out your pencil NOW—check the training that appeals to you—sign your name and address—and put it in the mail.

There is, of course, no obligation—but there's a great big OPPORTUNITY—and it's automatically set aside for the man who ACTS.

LASALLE EXTENSION UNIVERSITY

The Largest Business Training Institution in the World

LASALLE EXTENSION UNIVERSITY Dept. 383-R CHICAGO, ILLINOIS

Please send me catalog and full information regarding the course and service I have marked with an X below. Also a copy of your book, "Ten Years' Promotion in One," all without obligation to me.

- | | | | |
|---|--|---|---|
| <input type="checkbox"/> Business Management: Training for Official, Managerial, Sales and Executive positions. | <input type="checkbox"/> Traffic Management—Foreign and Domestic: Training for positions as Railroad or Industrial Traffic Manager, etc. | <input type="checkbox"/> Industrial Management Efficiency: For Executives, Managers, Office and Shop Employees and those desiring practical training in industrial management principles and practices. | <input type="checkbox"/> Expert Bookkeeping: Training for position as Head Bookkeeper. |
| <input type="checkbox"/> Modern Salesmanship: Training for Sales and Advertising Executives, Solicitors, Sales Promotion Managers, Salesmen, Manufacturers' Agents and all those engaged in retail, wholesale or specialty selling. | <input type="checkbox"/> Railway Station Management: Training for Station Accountants, Conductors and Agents, Division Agents, Traveling Auditors, Transportation Inspectors, Traveling Freight Agents, etc. | <input type="checkbox"/> Personnel and Employment Management: Training for Employers, Employment Managers, Executives, Industrial Engineers. | <input type="checkbox"/> Business English: Training for Business Correspondents and Copy Writers. |
| <input type="checkbox"/> Higher Accountancy: Training for positions as Auditor, Comptroller, Certified Public Accountant, Cost Accountant, etc. | <input type="checkbox"/> Banking and Finance: Training for executive positions in Banks and Financial Institutions. | <input type="checkbox"/> Modern Business Correspondence and Practice: Training for Sales and Collection Correspondents; Sales Promotion Managers; Credit and Office Managers; Correspondence Supervisors, Secretaries, etc. | <input type="checkbox"/> Commercial Speech: Training for positions as Foreign Correspondent with Specializing in economics. |
| <input type="checkbox"/> Law: Training for Bar; LL. B. Degree. | <input type="checkbox"/> Modern Foremanship and Production Methods: Training in the direction and handling of industrial forces—for Executives, Managers, Superintendents, Contractors, Foremen, Sub-foremen, etc. | | <input type="checkbox"/> Effective Speaking: Training in the art of forceful, effective speech for Ministers, Salesmen, Fraternal Leaders, Politicians, Orators, etc. |
| <input type="checkbox"/> Commercial Law: Reading, Reference and Consultation Service for Business Men. | | | <input type="checkbox"/> C. F. A. Coaching for Advanced Accountants. |

Name _____ Present Position _____ Address _____



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I Will Train You At Home

Stop right here. This is **YOUR** opportunity! Electricity is calling you, and the Electrical Business is in for a tremendous increase. But it needs more trained men—at big pay. By my **Home Study Course in Practical Electricity** I can train you for these positions.

FREE! BIG ELECTRICAL OUTFIT

A fine outfit of Electrical Tools, Instruments, Materials, etc., absolutely **FREE** to every student. I will also send you **FREE** and fully Prepaid—Proof Lessons to show you how easily you can learn Electricity and enter this splendid profession by my new revised and original system of Training by Mail.

RADIO COURSE FREE

Special newly-written wireless course worth \$45.00 given away **FREE**.

Free Use of Laboratory

I have a large splendidly equipped Electrical Laboratory where you can come at any time for special instruction without charge. Several competent assistants—practical engineers—are in charge.

Earn Money While Learning

I give you something you can use **now**. Early in my **Home Study Course** I show you how to begin making money in Electricity, and help you get started. No need to wait until the whole course is completed. Hundreds of students have made several times the cost of their course in spare time while learning.

Earn \$70 to \$200 a Week

You've always had a liking for Electricity and a hankering to do electrical jobs. Now is the time to develop that talent; there's big money in it. Even if you don't know anything at all about Electricity you can quickly grasp it by my up-to-date, practical method of teaching. You will find it intensely interesting and highly profitable. I've trained and started hundreds of men in the Electrical business, men who have made big successes. **YOU CAN ALSO**

BE A BIG PAID Electrical Expert

What are you doing to prepare yourself for a real success? At the rate you are going where will you be in ten years from now? Have you the specialized training that will put you on the road to success? Have you ambition enough to **prepare** for success, and get it?

You have the ambition and I will give you the training, so get **busy**. I am offering you **success** and all that goes with it. Will you take it? I'll make you an **ELECTRICAL EXPERT**. I will train you as you should be trained. I will give you the benefit of my advice and 20 years of engineering experience and help you in every way to the biggest possible success.

Valuable Book Free

My Book "How to Become an Electrical Expert," has started many a man on his way to fortune. I will send a copy free and prepaid to every person answering this advertisement!

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Act Now! Good intentions never get you anywhere. It is action, alone, that counts. **NOW IS THE TIME TO ACT.**

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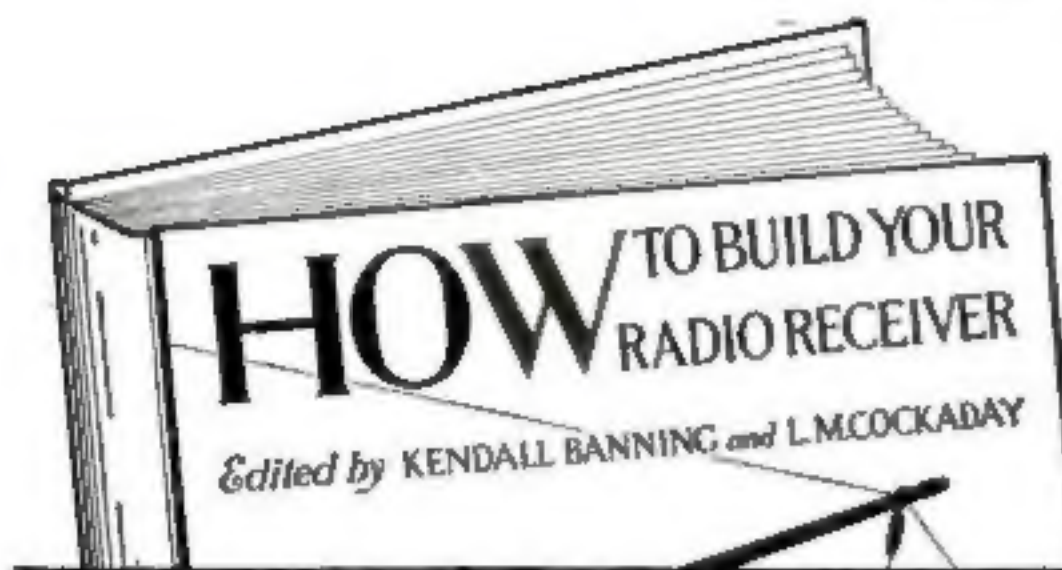
Name

Address

City State

DEAR SIR: You may send me entirely free and fully prepaid, a copy of your book, "How to Become an Electrical Expert," and particulars about your Home Study Course in Electricity.

The Cooke trained man is the "Big Pay" man



96 Page **FREE** Handbook

Edited by Kendall Banning
and

L. M. Cockaday

Popular Radio's New Book

"How To Build Your Radio Receiver"

POPULAR RADIO'S new 96-page handbook, edited by Kendall Banning and Laurence M. Cockaday, is now ready for delivery. For a limited time only, as an introductory offer, it will be given away free!

There has long been a need for such a book as this, describing fully and completely the several different types of radio receiving sets which have proved most effective, and *how to build them*.

Popular Radio's new book, "How to Build Your Radio Receiver," has been carefully planned to fill this need. No pains have been spared to make this book the most comprehensive and valuable contribution of its kind ever published for the radio enthusiast who, with or without previous technical knowledge or training, wishes to construct a radio receiving set of his own that will meet his every requirement.

"How to Build Your Radio Receiver" gives complete specifications for the construction of *seven* separate and distinct receiving sets—covering the most amazing range and variety of circuits, from the most modern simple crystal set to the famous Super-heterodyne.

All working details are given—the lists of parts required and their

approximate cost; complete hook-ups and circuit diagrams and *how to read them*; illustrations making all points clear, and simple instructions on how to assemble, mount, wire and operate each set.

Nor have any helpful pointers been omitted. In this new book, edited by Mr. Banning and Mr. Cockaday, you will also find scores of valuable hints and suggestions about aerials, how to select your parts, how to install your set, tips on tuning, and how to learn the code.

In all, a book you will not want to be without—one that will be worth many dollars to you. Yet, if you act at once, it will not cost you a penny. We will send you a copy of this valuable handbook absolutely free with a year's subscription to POPULAR RADIO, the leading magazine in the radio field, edited by Kendall Banning and L. M. Cockaday. If you are already a subscriber, you may renew or extend your subscription for an additional year and still secure one of the first copies of this valuable book *absolutely free*.

The Coupon printed at the bottom of this page provides a convenient means for you to secure one of the first copies of this handbook free. *But you must act at once!*

A \$5 Crystal Set

The simplest up-to-date set for local broadcast reception. Approximate range 15 miles. Clear signals on headset without distortion. No operating cost.

The Haynes Single Tube Receiver

May be made at an approximate cost of only \$15 for parts. Simple to tune, selective, good audibility. Long distance range up to 1,000 miles on ear-phones.

A Two-Stage Audio-Frequency Amplifier

May be added to any set, crystal or tube, to strengthen the received signals so they will operate a loud speaker. Easy to construct, efficient, and costs only about \$15 for parts.

The Cockaday 4-Circuit Tuner

A 3-tube set, famous for its high selectivity and beautiful tone. Cost of parts about \$40. Receiving range approximately 1,500 miles on a loud speaker.

A 5-Tube Tuned Radio Frequency Receiver

The possibility of "oscillation and re-radiation" is eliminated. May be built at a cost of only \$90 for parts. Range about 1,000 miles on loop or indoor antenna, and 2,500 to 3,000 miles on outdoor antenna.

7 Remarkable Receivers

Illustrated Diagramed Described

EACH of the sets described in POPULAR RADIO'S new handbook has been selected as the most *ideal* of its kind—for distance, selectivity, tone, volume, simplicity of construction, ease in tuning, reliability and general all-around satisfaction.

You will find sets employing both crystal and vacuum tube detection, with regenerative amplification, audio-frequency amplification, "push and pull" power amplification, radio-frequency, compensated radio-frequency and intermediate wave radio-frequency amplification.

You have your choice of crystal, one-tube, three-tube, five-tube, six-tube or eight-tube sets—the broadest selection anyone could ask for, all clearly illustrated, charted and explained in the simplest possible terms.

FREE

As a special introductory offer, for a limited time only, this book will be given FREE with a year's subscription to POPULAR RADIO at \$1. Simply mail your remittance with the handy coupon below, and a FREE copy of "How to Build Your Radio Receiver" will be sent you, postage prepaid. Your subscription will be entered at once.

The "Improved" Cockaday 4-Circuit Tuner

Probably the most important contribution yet made to the equipment of the radio fan. A compact 5-tube set with a receiving range of over 3,000 miles. Cost of parts about \$95. Automatic tuning and power amplification. Maximum volume of sound, excellent reproduction and no interference.

The Regenerative Super-heterodyne Receiver

More sensitive, more selective and more simple to tune than any other 6-tube receiver yet developed. Cost of parts approximate \$100. Range of 3,000 to 4,000 miles on a loud speaker. Has been called the "Rolls-Royce" of radio receivers.

—Also innumerable practical suggestions and complete list of U. S. and chief foreign Broadcasting Stations of 20 Watts power and up.

POPULAR RADIO, Dept. 132
9 East 40th Street, New York City

MAIL THIS COUPON NOW!

Please send me, postage prepaid, a FREE copy of POPULAR RADIO'S new handbook, "How to Build Your Radio Receiver," edited by Kendall Banning and L. M. Cockaday. I enclose \$3 for a year's subscription to POPULAR RADIO which entitles me to this book absolutely free.

NAME.....

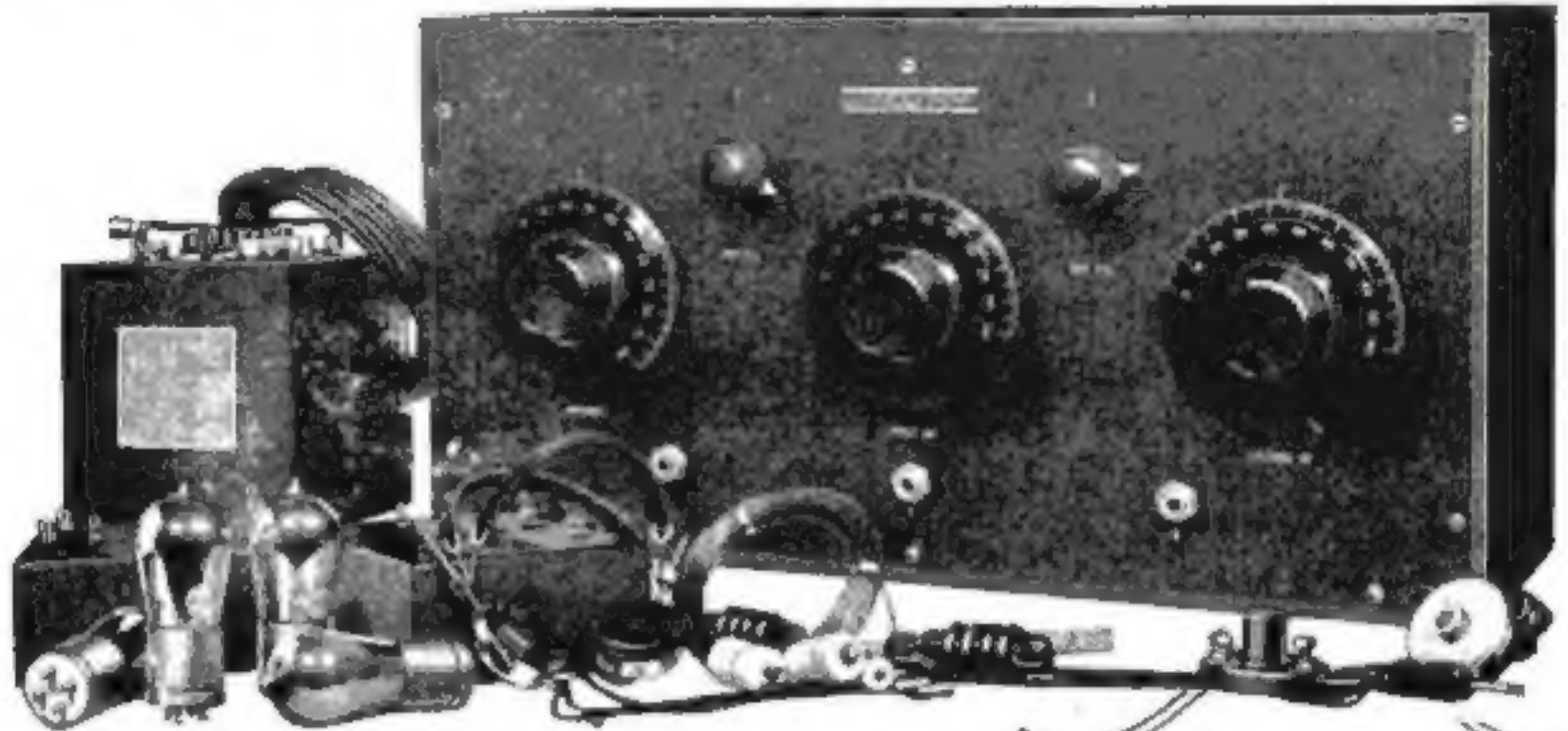
STREET AND NO.....

CITY AND STATE.....

(No extra for Canada. Foreign countries 50 cents postage extra)

Hazeltine Neutrodyne!

The wonder radio receiver that has taken the country by storm—that people are standing in line to buy, will be sent to you on this great special offer. Set "Factory Built" by the Garod Corporation, Newark, N. J., under Hazeltine Patents



Complete Outfit —
\$20⁰⁰ Down

All these accessories included:

4 Vacuum Tubes.
 6 volt—Storage Battery.
 2—45 volt "B" batteries
 1 pair of head phones with plug
 1 Nathaniel Baldwin special phonograph loud speaker unit.
 Aerial, wiring equipment, insulators, lightning arrester, etc.

This outfit includes either the Baldwin Loud Speaker Phonograph Unit as listed above, or at a small additional cost you can have the Nathaniel Baldwin Loud Speaker Horn.

Nothing more to buy!

Bring it to you Complete and Ready-to-Use—Balance in Easy Monthly Payments

HERE, AT LAST, is a Radio Receiver that is performing new miracles—things never before thought possible. And on our limited offer you enjoy its wonders for only a small payment down—remainder in easy monthly payments. Write for the offer we are making. Mail coupon.

In Chicago, New York and other big cities, people stand in line to get a chance at the limited supply of these sets that come into the big stores. They wait—they beg for them. They even pay premiums over list prices—anything to get a Neutrodyne.

And why not? Was anything so wonderful ever dreamed of before Mr. Hazeltine developed this Radio Marvel? No! Before you can even understand the marvelous accomplishments of the Neutrodyne, you must revise all your old ideas of

radio values. For instance, that expression "selectivity" — it used to mean one thing, but Neutrodyne has given it an entirely new meaning. Forget all past conceptions—try this Neutrodyne and you will see how you can tune out powerful local stations and bring in distant programs.

Every Neutrodyne factory is working to capacity. Their product is going mostly into the big cities and even then there is not enough to fill more than a small part of the demand. But Babson Bros.' purchasing power has secured some sets for their friends and customers in other places.

We now offer one to you. We do not ask a premium. We sell you the set at list price. We even save you some money on your accessories. And on top of all this we sell you this complete outfit on easy installment payments — and with a money back guarantee. We make it possible for those who act quickly to own a Neutrodyne—and the finest Neutrodyne ever built. And on a remarkable easy payment offer. Write!

Write Today for our special easy payment offer on this complete "Factory Built" Neutrodyne outfit. Do not delay. Our present supply is very limited. This announcement will create a demand far greater than we can supply. Remember, you may have your Radio set NOW and enjoy it while paying. Mail coupon now.

Babson Bros., 2843 West 19th Street, Dept. 13-63, Chicago, Ill.

Babson Bros., 2843 West 19th St., Dept. 13-63, Chicago, Ill.
 Please send me your special offer on a complete Neutrodyne outfit on Easy Monthly Payments.

Name _____

Address _____



Money Making Opportunities for "Popular Science" Readers

Another \$25.00 IN PRIZES

To win one of these cash prizes is easy, and every reader is invited to enter this fascinating competition. Just write a letter of not over seventy words answering this question:—

What advertisement of "Money Making Opportunities" in this issue interests you most and why?

Here are the prizes we will pay for the ten best letters answering the above question:—

First Prize \$10.00
Second Prize 5.00
Third Prize 3.00
And 7 Prizes
of \$1.00 each 7.00

First read every one of the "Money Making Opportunity" advertisements on pages 8 to 26. Check the ones that interest you. Then read over the ones you have checked and decide on the one that interests you most.

Then write a short letter, *not more than seventy words*, telling us why the advertisement you pick interests you most. Remember that ten prizes will be awarded. You have a good chance of winning one of them. Be sure to mail us your answer before March 1st. The prizes will be awarded, in the order of their merit, for the letters that are most interesting and best expressed.

The names of all the prize winners and the letters that win the first two prizes will be printed in this column in the May issue. Address your prize letter to

Contest Editor

POPULAR SCIENCE MONTHLY
335 West 39th Street, New York City

Last Month's Prize Winners

The First Prize of \$10.00 goes to Mr. T. Metcalfe, 129 S. Ardmore Ave., Los Angeles, Cal., for his letter on the advertisement of the Metal Cast Products Company. Here is Mr. Metcalfe's letter:

Dear Sirs:—

The Metal Cast Products Company evidently realizes that to win, though it may be the goal of us, is not the secret of successful Classified Advertising. Its "important announcement," by its very size, attracted my attention, and having obtained that, proceeded to tell me clearly, without confusing qualifications, just what the company had to offer. The proposition interested me to the extent that I immediately sent off a reply.

TOM METCALFE.

Mr. James E. Noble, of Toronto, Ont., Canada, wins the second prize for his letter on the advertisement of E. Palmer.

Contest Editor:—

I was attracted by E. Palmer's ad as it appears in the January issue. It offers of course what most of readers desire, a business of their own, especially if like myself, they are unemployed. I desire to tender my sincere thanks to Popular Science for disclosing my position to this opportunity. I am more than satisfied with the value I received for the money I invested with your advertisement.

JAMES E. NOBLE.

The Third Prize goes to C. N. Cropper, Marysville, Utah.

The Winners of the other seven prizes are:
Banner Mills, Greenville, S. C.; E. C. Holland, Birmingham, Ala.; E. M. Hoefel, St. Louis, Mo.; Jess Thurston, Naugatuck, Conn.; Raymond R. Rosenblatt, Detroit, Mich.; J. M. Freeman, West Hickory, N. C.; Edmund H. Brown, New York, N. Y.

Rate 25 Cents a Word. Advertisements intended for the May issue should be received by March 8th.

RADIO AND SUPPLIES

YOU don't need miles to get out of town. If you want new stations on your crystal set, write me today. Mine works 400 to 1,000 miles without tubes or batteries! Thousands have bought my plans and now get results like mine. Chances often cost less than dollar. Send self-addressed envelope for further information. Leon Lambert, 2554 So. Volusia St., Wichita, Kansas.

RADIO generators 500 V 100 Watts \$28.50 each. Battery chargers \$12.40—High speed motors. Motor-generator sets, all sizes. Motor Specialties Co., Cranston, Pennsylvania.

RADIO Book, 25c. Ammies wanted. Hadley, 46 Howard St., Bridgeport, Conn.

LOUD speaking Crystal Set, Broadcastings heard throughout house. Easily constructed. Instructions complete 25c. Catalog free. Stuntz Wireless Mfg. Co., 5815 Penn. Ave., Pittsburgh, Pa.

BLUR Generators, brand new, 6 volts maximum output 22 amperes at 2000 r. p. m. Government paid \$45.00 each, our price \$10.00. General Sales Company, 1921 E. Michigan Avenue, Chicago, Ill.

AMATEUR Regenerative Receivers (Lamont) 500 to 1000 miles distance, complete with tube, phone, batteries, serial, \$26.75. Cash with order. William Gibbons, 535 Palace Building, Minneapolis, Minn.

ADVERTISING

ADVERTISE in 24 metropolitan dailies, 24 words, \$15.00. Helpful Guide listing 1000 publications, 40 stamps. Wade Company, Baltimore Bldg., Chicago.

ADVERTISING rates for magazines and weeklies free. Charles A. Lutz, Apartment 241, York, Pennsylvania.

THE RURAL weeklies, \$4.00. Ad. Meyer, 4119 F. St., Hartford, Conn.

ADVERTISERS: Your 35 word ad in 51 magazines \$7.00. Free Advertising Booklet. Auto-City Agency, 2747 Gladstone, Detroit.

ADVERTISING NOVELTIES

GILT lettered Advertisements—Pencil for you. Buy direct; save entire middleman's profit. Samples free (no agents). Address B. Mundel & Co., 10-14 Lincoln St., Yonkers, N. Y.

DUPLICATING DEVICES

"MODERN" Duplicators save Time, Labor and Money. Get business. Reproduced Typewriting or Printed Letters, Drawings, Letters, Maps, Menus, Bills, Notices, Specifications, Maps or anything in one or more colors. Prints two per minute. Special sale on 20 days' free trial, \$2.25 up. Booklet free. J. V. Durkin-Reeves Co., Pittsburgh, Pennsylvania.

STENCIL Duplicators—Note, \$3.00; Letter, \$4.00. Hand Use. Typewriting—Handwriting. On Approval. Primes Specialty Co., 3-N, Princeton, Pa.

TYPEWRITERS AND SUPPLIES

TYPEWRITERS all makes. Have one-half. Thoroughly rebuilt in our factory by the famous "Young Process." Fully guaranteed. Free trial. We handle all standard makes. Cash or sold on easy terms. Write for Catalog. Young Typewriter Co., Dept. 3015, Chicago, Ill.

ALL makes, rebuilt, refinished and guaranteed ten years. \$15.00 up shipped previous 30 days' time. Get our prices and agents proposition. Typewriter Manufacturers Exchange, Fordham, New York.

TYPEWRITERS sold on payments. Free trial. Payne Company, Dept. 320, Rosedale, Kansas.

LABORATORY AND CHEMICAL

EXPERIMENTERS. Complete supplies for the chemical laboratory. Catalogue free. National Scientific Supply Co., 241 Pennsylvania Avenue, Washington, D. C.

YOU R chemical problem solved and working process furnished for five dollars. When your process or formula is furnished by me 25 years of experience is back of it. This means expert service and satisfactory results. Write me. W. Steinhilber Richards, Consulting Chemist, Box 2402, Boston, Mass.

SEE radium rays using our \$1.00 Spharhoscope. Laboratory apparatus, chemicals. Send for bargain prices. Washington Scientific Co., 2109 Fourteenth Street, Washington, D. C.

CHEMICAL Service. Potassium analysis, methods, experiments. Jacob Shyster, Chemist, 2527 East St., Davenport, Iowa.

PRODUCTS: formulas duplicated, improved, cheapened. Ethelred H. Cox, Box 1628, Chicago.

TRADE SCHOOLS

PAINT Automobiles, Trum Automobiles, Become a Certified Electrician, Auto Battery Builder, Licensed Expert on Starting and Lubricating, Metal Finisher, and a complete course in Auto-Repairing, Brickinglaying and Plastering. We fit you for a big money job. Make you an expert able to step right into a position paying \$45 to \$100 per week. You are paid while learning. We maintain our own dormitories. Come to Detroit, the Automobile hub: the World's wonder city. Write today. Standard Trades School, 416 Woodward, Detroit, Mich.

**More Money Making Opportunities
on pages 10 to 26**

AUTOMOBILES AND ACCESSORIES

PATENTS—Write for our Guide Book, List of Patent Buyers and "Records of Invention Blank" before disclosing inventions. Send model or sketch of your invention for our free opinion of its patentable nature. Terms reasonable. Victor J. Evans & Co., 180 Ninth, Washington, D. C.

AUTOMOBILE parts—Used parts for most any car at half factory list prices. Allen, Irwin, Buick, Cadillac, Chrysler, Chevrolet, Dodge, Ford, Grant, Hudson, Maple, Oakland, Overland, Oldsmobile, Reo, Studebaker and many others. Send list of parts wanted. Maxwell Bros., 4100 Olive Street, St. Louis, Missouri.

AUTOMOBILE owners, engineers, mechanics, send for free copy America's popular motor magazine. Contains helpful, money-saving articles on repairing, overhauling, lighting, carburetors, batteries, etc. Automobile Digest, 523 Butler Bldg., Cincinnati.

M. P. LAUGHLIN—Patents—Engineer—Attorney—Specializing Power-Automotive Inventions. 48 East 124 St., New York.

FORD ACCESSORIES

SPEEDSTER lamp—see "Red-Kut" ad, page 164.

MOTORCYCLES, BICYCLES, SUPPLIES

DON'T buy a bicycle motor attachment until you get our catalogue and prices. Shaw Mfg. Co., Dept. 4, Galveston, Kansas.

DON'T pay \$50 for bicycles, buy motor cycles \$50 to \$100. Easy terms. Pay as you ride. Non acid Ford tires \$4, tubes \$1.25. Bicycles, motor cycles at factory prices; talking machines at half price. Harmon 20c. Send 10c in stamps for catalogue. Dentiger Price Cutter, Rochester, New York.

OVERSTOCKED—200 Used Motorcycles. Must be sold at once. We have Harley-Davidsons, Indian, Hendersons, Excelsiors, Clements. Prices \$25.00 up. Write for our Bargain List. Myerson Brothers, Dept. C, 14, Berkeley St., Boston, Mass.

MODELS AND MODEL SUPPLIES

WE make working models for inventors and experimental work, and carry a complete stock of brass gears and model supplies. Send for catalogue. The Fiero Model Works, Tinley Park, Illinois.

MODEL making and experimental work; modern shop, expert workmen. Manufacturing. Latson E. & Sigs, Co., 626 W. Jackson, Chicago.

MODELS and Tools made to order. Estimates. Schmidt, 224 Canal St., N. Y.

WE Build Models, design, develop, and manufacture articles in large or small quantities. Homsey Machine Products and Mfg. Co., 1385 E. 17th St., Cleveland, Ohio.

MODEL steam engines, boilers, boats, model ship and naval fittings, model makers supplies. Send 20c for new and enlarged illustrated catalogue and handbook. Harbo Mfg. Co., Dept. C, 3214 Woodland Avenue, Philadelphia, Pennsylvania.

MOTORS, ENGINES, MACHINERY

MOTORS—O. E. 1/2 H.P., \$15.00; 1 H.P., \$22.50; 1 1/2 H.P., \$30.00. Generators, 8 volts, 10 amp., \$15.00; 22 volt, 600 watt, \$30.00. Other sizes, low prices. Motor Specialties Co., Cranston, Pennsylvania.

STEPTON medium priced line of shapers, Milling Machines, Lathes, and Die Grinders with rotary four manufacturing costs. Established since 1865. Catalog upon request. The John Stepton Company, Camp Washington, Cincinnati, Ohio.

SHOP EQUIPMENT

TRICULAR Saw for bench. Write Box 17, Hackettstown, New Jersey.

AVIATION

THE American School of Aviation announces a new correspondence course in mechanics of aviation. A thorough training in practical aeronautics. American School of Aviation, Dept. 1743, 1601 Michigan Ave., Chicago, Illinois.

PROPELLERS for airplane propulsion, 5-foot diameter, \$12; 6-foot for Ford, \$15; others in proportion. Motorcycle sleigh blueprints, 75c. Ford Size, \$1.00. Pictures free. Crawford Motor and Airplane, Long Beach, California.

AMERICAN MADE TOYS

MANUFACTURERS on large scale, also home workers wanted to manufacture metal toys and novelties. Millions needed of barking dogs, wag tail pups, wild animals, automobiles, Indians, cowboys, baseball players, cannons, toy soldiers, growing monsters, Statues of Liberty, miniature castles of capital, bathing girl souvenirs and others. Unlimited possibilities. Guaranteed casting forms furnished manufacturers at cost price from \$5.00 up, with complete outfit. No experience or tools necessary. Thousands made complete per hour. We buy goods all year and pay high price for finished models. Cash on delivery. Contract orders placed with manufacturers. Catalog and information free. Correspondence invited only if you mean business. Metal Cast Products Co., 1606 Boston Road, New York.

ELECTRICITY

THE BIG PAY TRADE

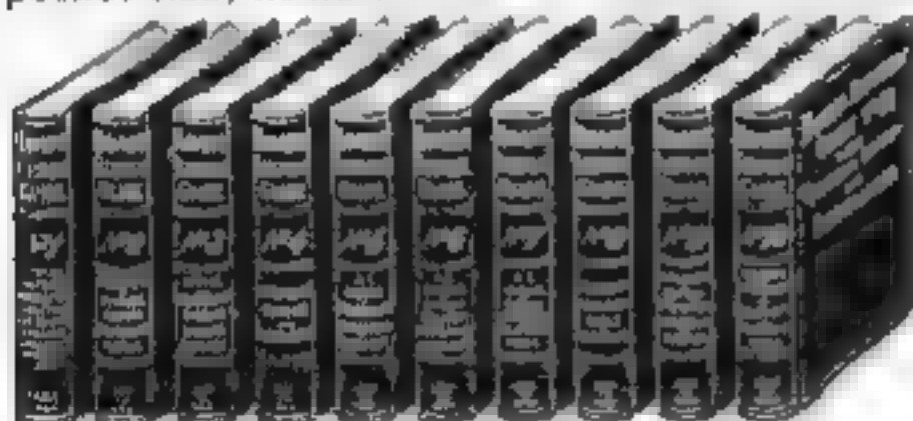
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BY EASY SPARE-TIME READING

Hawkins Electrical Guides

1600 PAGES—4700 PICTURES—\$1 A VOLUME—\$1 A MONTH—10 VOLUMES

Know the facts in Electricity. They mean more money and better position for you. Hawkins Guides tell you all you need to know about Electricity. Every important electrical subject covered so you can understand it. Easy to study and apply. A complete, practical working course, in 10 volumes. Books are pocket size; flexible covers. Order a set today to look over.



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Not a cent to pay until you see the books. No obligation to buy unless you are satisfied. Send coupon now, today, and get this great big library and see if it is not worth \$10.00 to you—you pay \$1.00 a month for ten months or return it.

THEO. AUGEL & CO., 72 Fifth Ave., New York City

Please submit me for free examination the **HAWKINS ELECTRICAL GUIDE** (Price \$1 a volume) Ship to me prepaid in 10 numbers. I enclose for postage and handling \$1.00. I will pay you \$1.00 each month and I paid.

Name _____
Occupation _____
Employed by _____
Home Address _____
Reference _____

Money Making Opportunities

FORMULAS

Formula A catalog free. C. A. Jones, Apartment 211, York Building, New York.

Formula B catalog free. 4400 pages—2100 pictures. Hillside Laboratories, 2805-134 Upper Harvey, Illinois.

Formula C catalog free. 4400 pages—2100 pictures. Hillside Laboratories, 2805-134 Upper Harvey, Illinois.

Formula D catalog free. 4400 pages—2100 pictures. Hillside Laboratories, 2805-134 Upper Harvey, Illinois.

Formula E catalog free. 4400 pages—2100 pictures. Hillside Laboratories, 2805-134 Upper Harvey, Illinois.

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Formula I catalog free. 4400 pages—2100 pictures. Hillside Laboratories, 2805-134 Upper Harvey, Illinois.

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Formula J catalog free. 4400 pages—2100 pictures. Hillside Laboratories, 2805-134 Upper Harvey, Illinois.

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**More Money Making Opportunities
on pages 8 to 26**

A New and Mysterious Happiness

A Startling and Sensational Discovery

A Mysterious Secret

NO wonder men and women everywhere are excited over this startling discovery of a Universal Law and Power by which a new meaning is given to every pleasure, function, action and to every joy, gratification and happiness.

Who could resist becoming excited if the pleasurable realization of life in all of its phases were multiplied and intensified?

You, too, will become excited over this great discovery because it will give you a new thrill—an intense and lasting thrill.

This new and startling discovery of a supreme natural law of life, health and pleasure is joyfully revolutionizing the lives of thousands of men and women all over the world. It is bringing them a new kind of pleasure, happiness, health, strength, confidence, energy and power of personality and success. It is giving them such marvelous energy of mind and body, and they enjoy life so fully, so intensely, so dominantly, and so thoroughly that the old life to which they were accustomed appears totally inferior in every respect.

The possession of this new and mysterious natural law gives a new idea of how truly vital, alive, joyful, healthy and happy a human being can be—how easily one can be overflowing with life, energy, bubbling vitality and the fire of triumph. Although thoroughly natural and simple, nevertheless it accomplishes seemingly impossible results without sacrifice, active effort or cost.

A new life with a unique thrill is yours when you possess this newly discovered natural law of supreme life, health and pleasure. It is no longer necessary for one to spend money for treatments and drugs and dieting and books and systems and cures and pills and devices, because perfect and supreme health and life are absolutely free through this marvelous natural law.

Why be weak, why be ill, why be fat, why be thin, when you may, absolutely free, become in every way perfect and supreme through this sensational natural law?

This extraordinary natural law yields

amazing nerve force, amazing energy, amazing vitality and amazing power of every character of mind and body—a new and superior life.

Through this sensational natural law you may have all of the benefits of exercise without exercise; all of the benefits of conscious deep breathing without conscious deep breathing; the full and complete benefit of every vitamin and organic iron without drugs or dieting; all of the benefits of medicine and drugs without medicine and drugs; all of the benefits of auto-suggestion, hypnotism and psychology without auto-suggestion, hypnotism and psychology; all of the benefits of dieting, and every other kind of treatment, device or assistance without these treatments.

Through this amazing natural law, anyone can rid self permanently of every human weakness; no matter who you are, this Natural Law can demonstrate to you that you do not yet know the full meaning of joy, pleasure, happiness, vitality and gratification.

This Natural Law is ready to give you a new realization of the meaning of life and enjoyment.

This extraordinary and Universal Law does not require you to actively do anything or give up anything. It requires no exercise, no time, nor conscious deep breathing—no stretching, dieting, drugs nor medicines.

This natural and supreme law must not be confounded with hypnotism, autosuggestion, psychology, spiritual science, psychic science, mental science, nor with electricity or any other method—mental or physical—ever devised in the past.

No self-hypnotizing phrases to repeat—no yielding, no recession, no giving up of anything, nothing to study, nothing to actively practice, no books to buy, nothing to memorize, no self-deception—nothing but truth—reality—Natural Law. Perfect health cures every known and conceivable disease. This startling natural law is guaranteed to give perfect health.

If you are not enjoying life to the full—if you are in any way handicapped—if you are not in possession of all of the powers of mind and

body to the highest degree, you owe it to yourself to at once procure for yourself, free of charge, this revolutionary natural law.

Through this supreme natural law anyone may have the health and vitality of a lion or tiger.

Remember that the demonstration and results are immediate and free. This powerful natural law transforms the gloom of disease into the bloom of health, as the rays of the spring sun transform the dead soil into a "sea" of luxuriant vegetation. It is destined to revolutionize human health and happiness—Humanity.

This natural law is most marvelous, most simple, most subtle and most powerful. It is the Law of Creature Power.

Remember there is nothing active to do, nothing to study, nothing to believe, no time to waste, no habits to give up, nothing to lose—there is no mystery—it is merely Natural Law.

You would not be without this secret if you could imagine how delightfully transformed your life would be through the possession of this new and deeper realization of happiness, pleasure, joy and gratification.

This secret is offered to you absolutely free. There are no "conditions" or "strings" attached to this offer.

Special Note—Swoboda has a priceless secret for every human being who wishes to be happier, healthier, more vital and successful in a new degree.

ALOID P. SWOBODA,
1231 Berkeley Building,
21 West 44th Street, New York City.

Send me FREE the Swoboda Natural Law of Supreme Life and Health.
To help cover the cost of publishing and mailing, I enclose postage. (Not more than ten cents, please.)

Name.....
(Write Plainly)

Address

City..... State.....

Special Note—Many individuals who have obtained this secret claim it is absolutely priceless—worth millions.



"I guarantee that the new method which penetrates to the starved root cells will produce a new, healthy growth of hair in 30 days or your money will be refunded. And furthermore, I want you as the user to be the sole judge. My special free book, now ready, explains the method in detail and tells you precisely why I am able to make this unusual free proof guarantee."

ALOIS MERKE.

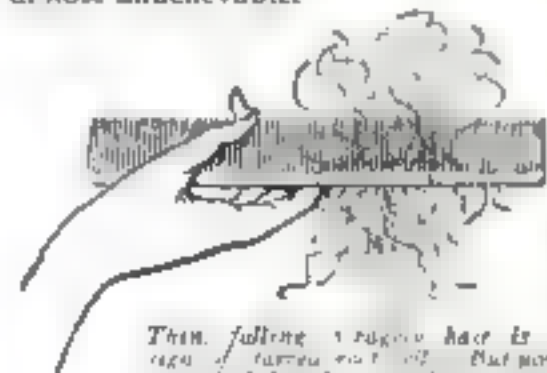
New Hair in 30 Days -or Costs You Nothing!

Alois Merke discovers a new, simple method guaranteed to grow thick, beautiful, luxuriant hair, or money instantly refunded. Gives new life and health to hair that is thin, falling, lifeless.

At the Famous Merke Institute, Fifth Avenue, New York, letters are pouring in from all over the country requesting information concerning this new method for growing hair. So successful is it that it has been guaranteed to grow new hair in 30 days or cost nothing!

To women this method is particularly interesting as it often transforms thin, falling hair into rich, luxuriant beauty in an unbelievably short time. It is unlike anything ever known in this country. It penetrates to the starved root cells, revitalizes and nourishes them and the hair grows thick, lustrous, beautiful.

There is no massaging, no singeing, no unnecessary fuss or bother of any kind connected with this new method. It is simple, pleasant. Already hundreds of women who had thin, falling hair, hundreds of men who were "thin on top," have acquired new luxuriant growths of hair. Often the results are almost unbelievable.



Thin, falling, lifeless hair is a sign of starved root cells. But now a method has been perfected which penetrates to the roots and stimulates them into new growth.

Thin Falling Hair Given Glorious New Health

Is your hair thin, lifeless? Does it fall out, break? Is it dull and without lustre?

All these conditions are nature's signs of starved or atrophied hair roots. Ordinary methods cannot revitalize the roots, cannot reach them; no more than rubbing "growing fluid" on the bark of a tree can make the tree grow. You must get right at the roots and stimulate them. This remarkable new method provides, at last, an efficient way of invigorating the roots themselves. The hair becomes brighter, thicker. New growths make their appearance within 30 days—if they don't there as the cost to you.

Some of the Amazing Results

The proof-guarantee is made possible only through splendid results that have already been achieved—on these few excerpts from letters testify. The letters are on file at the Merke Institutes and anyone may see them by coming to the office.

I have been bothered with dandruff for 20 years and had lost nearly all of my hair. I have used your treatment 30 days now and have a good growth of hair coming in.

Am glad to say I can see such great change in my hair. It is growing longer and my head is full of young hair that has made its way through since I have been using Merke Treatment.

I must frankly state I was skeptical as to your claim but a faithful use of Merke Treatment for a month has removed all

doubt and three of us are obtaining unbelievable results both in looks and growth.

Free Booklet Explains the Method

We have prepared a special free booklet called "New Way to Make Hair Grow" which tells you everything you want to know about the remarkable new method for growing hair. This booklet explains the method in detail, gives you many interesting facts and proofs concerning this new method. We know you would like a copy and we will be glad to send it to you absolutely without obligation.

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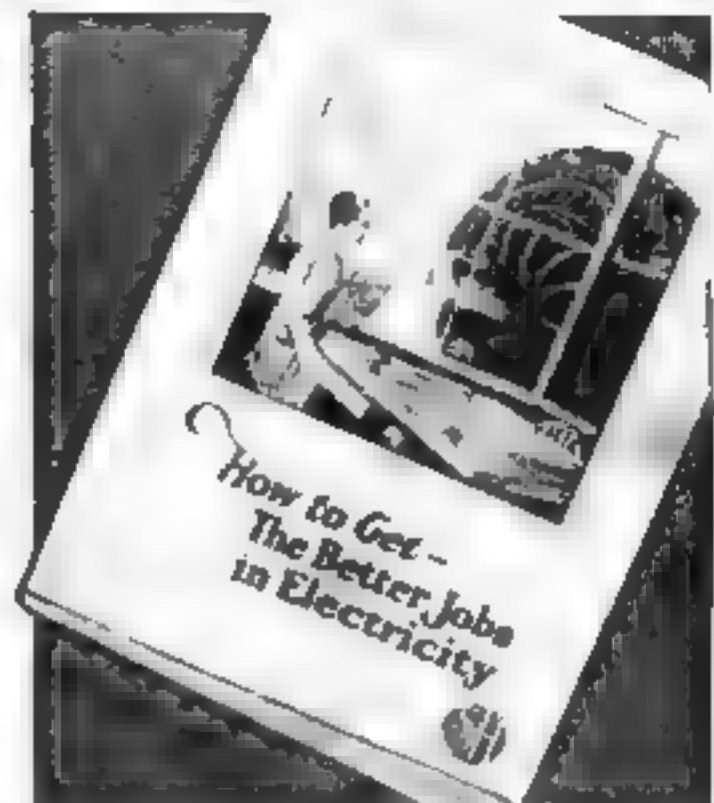
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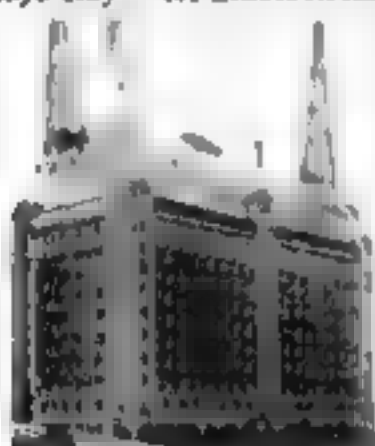
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BIG MONEY in spare time for one man in each locality making embossed show cards and price tickets for stores and others. Easy quick work. No training needed. New embossing machine does it all. 400¢ profit. High sell on high. T. W. Rushing of Chicago sold 275 first call. R. D. Duran averaged \$15 a day for 8 months. Many sold \$5 to \$20 daily. No special tool. Before you invest a penny we send you free sample cards to show merchants and convince yourself they sell at sight. Write today. **Praxmatic Corporation of America**, Dept. 400, Geneva, New York.

AGENTS First seller. **Iron Rubber Repair** for tires and gives supermen rubber at a saving of over 600 per cent. Put it on cold tire vulcanizes itself in two minutes, and is guaranteed to last the life of the tire or till the tire is worn out and is a necessary dealer. For particulars how to make big money and free sample, address **Ammon Rubber Co.**, 304 Ammon Building, Philadelphia, Pennsylvania.

GET our plan for monogramming automobiles, trucks, hand luggage and all sorts of articles by transfer method. Experience unnecessary. Exceptional profits. **Motorama Advertising Company**, Milwaukee, Ohio.

50¢ DAILY advertising without placing and redrawing lamps, reflectors, signs, beds, chandeliers by new method. Outlets furnished. Write **Gummet Co.**, Ave. F, Decatur, Illinois.

MAKE \$25 to \$50 week representing **Claw's Famous Philadelphia** Hosiery direct from mills for men, women, children. Every pair guaranteed. Prices that will free book. How to start, tells the story. **Claw's Famous Company**, Dept. 24, Philadelphia, Pennsylvania.

EVERYBODY uses extracts. Sell **Don Double Strength Extracts**. Complete line household necessities. Big territory. Write today. **Don Co.**, Dept. 222, Astoria, N. Y.

BIG MONEY and fast sales. Every owner buys gold initials for his auto. You charge \$1.00, make \$1.25. Ten orders daily easy. Write for particulars and free samples. **American Monogram Co.**, Dept. 47, East Orange, New Jersey.

WANTED Representatives in every factory in the United States. **Popular Science Monthly**, 224 West 43rd Street, New York.

NO. 1 PHOT selling rubber stamps, embossed show cards, etc. Write **Label Makers**, 100 E. 10th Street, Philadelphia.

AGENTS Wanted. **Remington New Fire** lighter with quality. Makes a superior illustration, not covers, blazes, factories, stores, practically any object. Not more than \$10.00 to \$15.00 a day in spare time. If you wish to establish a business of your own with unlimited possibilities for making big money, write today. **Remington Co.**, 14, Wyckoff Building, Dayton, Ohio.

PAID \$10 daily advertising business plan and advertising spots, handbills, chandeliers, lanterns, etc. Outlets furnished. **Y. Davis Laboratories**, 111 Broadway, New York.

GET our free sample card under articles, perfumes and specialties. **Wonderfully profitable**. **L. A. Levine Co.**, Dept. E, St. Louis, Missouri.

AGENTS Big profit. Best and cheapest window letters made. Easily applied. **Home Letters for Windows**. Particulars free. **Aladdin Company**, 1115 Second Avenue, New York.

REPRESENTATIVE men wanted as exclusive distributors for nationally advertised products. Not a work done selling but a profitable business opening. Men chosen will make generous profits. Write or wire **1124 E. 20th St., 10th Fl., Cincinnati, Ohio**.

AGENTS make \$100 profit handling with monogram, new design, window letters, transfer signs, etc. Write **Charles W. Horton Co.**, Dept. 24, Star, N. Y. City.

STAMPING names on children's toys, etc. Example \$10. Not short in this store, look big cash, etc. **Bertie Sales Corporation**, New York City.

AGENTS (Close Territory) **Johnson** takes every pen a mountain pen. Fast seller. Write for details. **Johnson** everywhere. **Johnson** territory offered. Sample free. **M. J. Johnson Company**, Tribune Building, New York.

REPRESENTATIVE make \$100 daily. We start you. Representatives wanted everywhere. **Wholesale Distributors**, Dept. 34, 600 E. Main Street, Chicago.

INSTANT sold. Highest largest profits without effort or cost. **Let's profit one day \$54**. Write quick. Free sample. **Tenthury** going fast. **Tenthury's Profit Mfg. Co.**, Dept. 11, Minneapolis, Minnesota.

FREE sample. **Rain Check Water**. Retain \$1.00. **Check** (free). **Hold Clear and Rainy Days**. No loss. No waste. No attachment. (1) **Rob** keeps **Washboard** clear. (2) **Home**, **Experience**, **Unnecessary**. **Nutrition Corporation**, Hartford, Conn.

MAKE money advertising outdoors, all kinds of printing. **Knives, spoons, auto headlights**. Outlets furnished. **Free** **Knives**. **International Laboratories**, Dept. 27, 311 Fifth Avenue, New York.

WATCHMEN can make \$5.00 a day selling our calendars, pencils, signs, advertising specialties, etc. Write for details. **Edwards**, 121 Liberty St., New York.

EASY plan to work for mechanics shop, etc. checks, during spare hours will add many dollars to their salaries. Also want persons who can give full time. Big wages assured. **Novelty Cutlery Company**, 27 Bar Street, Canton, Ohio.

MAKE A WEEK. **Get** our **Gold Letters** for store windows. Easily applied. Free samples. **Letters**, offer to general public. **Metallic Letter Co.**, 424A North Clark, Chicago.

AGENTS Everywhere. **Women's** and **children's** guaranteed shoes direct to wearer. **We deliver**. **A. P. Goodie**, Sales Manager. **The Allen Shoe Co.**, 110 Summer Street, Boston, Massachusetts.

APPLY to sell regular \$1.00 and \$1.50 ink and get paid for 200 and 500. Make \$15.00 daily. Write for particulars. **American Cravat Exchange**, 621 Broadway, New York.

AGENTS both sexes. We manufacture and control our household articles. Fast seller. **High profits**. **Exclusive territory**. Write now. **Connelly**, 121 Liberty St., New York.

PATENTS **Claw** lights with **Claw** Advertising **Frank**. Also **Electric** **Claw** **Monogram**. **Wonderful** **Sellers**. **No Competition**. **Big Steady Profits**. **Frank**, **Curt**, **Rain** **Plan** **Free**. **Drake Mfg. Co.**, Dept. P., Milwaukee, Wis.

More Money Making Opportunities
on pages 8 to 26

It Was REAL FUN -Learning to Play the Piano in 90 Days

By A Wife

We had been married only three years, and already Bob's love for me was slipping. Instead of remaining in evenings, he used to spend his time elsewhere, or devote his time to playing on his violin, entirely indifferent to me. Frankly, I was living through days of misery.

One day, while reading a magazine I came across an amazing story—of a woman who had learned to play the piano in 90 days! Was it possible? Fascinated, I read on and on, and learned how she had mastered the piano by herself, in her spare time, without a teacher.

I stopped. A wonderful thought had occurred to me. Why couldn't I do what this woman had? And—how happy I could make Bob by accompanying him on the piano! Full of enthusiasm, I wrote to the U. S. School of Music for their course. I, who had never known a single thing about music, was absolutely astonished at the remarkable simplicity of their print-and-picture method. As easy as the A. B. C!

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But my greatest happiness came the day that Bob found out. Words can't describe his look of astonishment. And what a change seemed to come over him as he eagerly drank in my story. Then it was I realized what music had meant to him. As he expressed it, playing the violin was absolutely flat without the accompaniment of a piano.

Today Bob finds new delight in his violin, and I have kept right on with my piano studies. Our musical evenings are a marked success and we are able to offer our friends entertainment they enjoy.



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REPTILES: The "Dandy" Post Road Sign. An absolutely new line in sign construction. Ideal outdoor advertising medium. Newton Mfg. Co. Dept. Dept. Newton, Iowa.

AGENTS and Distributors: Sell Vanities. The universal pocket companion. No competition. Everybody needs one fast seller. Big money. Boyce Novelty Co., 4427 Kinross Street, Chicago.

AGENTS (Men or Women): big profit all year round. Steady repeat. Write for information. O-K-O Remedy. Philadelphia, 1047 Nebraska Ave., Dept. P, Toledo, Ohio.

WANTED: salesmen for Boiler Compounds, Belt Treatments (Inventor also 300 different kinds of Paints, manufactured by us, the largest company of its kind sold directly to Industrial Plants and Institutions. If your application is approved, I will call on you personally anywhere in United States and start you off right. Humber 33 Union Square, New York.

PAINTER: The Wonderful Polishing Cloth that cleans all metals without liquid, grease or powder. Approved by "Good Housekeeping" and "Modern Housewife." Sell for 25c. Sample free. V. C. Shaw, 18 Mainboro St., Boston.

CASH IN on this quick seller. Wings cleared \$1000 with Newer Mail Razor Sharpener in its works. Purdy \$40.50 first day. Apply now to, also inexperienced, all orders in thirty minutes. No end to ready buyers. Exclusively territory for quick workers. Be first. Address Newer Mail Company, 101 Allen Blvd., Toledo, Ohio.

MAINTENANCE: Sell our Electric Heaters. Sell for \$17.50. \$5 for sample. Honeywell Heating Products & Mfg. Co., 1345 E. 17th St., Cleveland, Ohio.

HAIR EX: Universal Hair Care Cream sells in nearly everybody's hair and scalp. New hair cream and instant attention. Special selling system gives enormous income. Dept. P. N. Dapo & Co., 1345 E. 17th St., Dayton, Ohio.

IN to \$15 daily pay: Introducing New Style Guaranteed Heaters. All at once or regular free. No capital or experience required. Just show samples, write orders. Your pay in advance. We deliver and collect. Pleasant quick business. All colors. Service including other sales. Humber 33 Union Square, New York.

REPTILES: Sell our Electric Heaters. Sell for \$17.50. \$5 for sample. Honeywell Heating Products & Mfg. Co., 1345 E. 17th St., Cleveland, Ohio.

HEATING: They Are Still Hot! Sell our electric heaters. Sell for \$17.50. \$5 for sample. Honeywell Heating Products & Mfg. Co., 1345 E. 17th St., Cleveland, Ohio.

1000 money and fast sales: Every owner buys gold in his for his ad. You charge \$1.50, make \$1.44 in orders daily. Information and samples free. World Magazine Co., Dept. 25, Newark, N. J.

APPOINTMENT: Invention starts. Fully instantly colored weather double mirror. Big profit. Exclusive territory. Humber 33 Union Square, New York.

CAN you sell Ford also live at \$100 each? Write for plan. Dandy free. American Accessories Co., Dept. 25, Newark, N. J.

AGENTS: Make Big Money quick. \$400 to \$500 profit on each order paid in advance. Taking orders on our fine tailoring from friends and neighbors. Most all-wool samples, fashion, etc. in inventory. Entirely new and different style suits. Orders on sight. Best free. Write at once. Washington Tailoring Co., Dept. C-201, Chicago.

1000 MONTH: for Salesmen. Am rounding out 1924 sales force. Projections bright. No competition. Virginia territory to assign. \$1500 to \$2000 per month. \$1000 to \$1500 for part year. Best in representative. \$1000 to \$1500 per month. 1 offer annual opportunity to salesmen who qualify. Write at once. Address: F. H. Coppock Salesman National Advertising Service, Inc., P. O. Box 63, Baltimore, Md.

NEW Patented Household Article: 50% profit sold on Money Back Guarantee. Everybody buys. Wonderful money maker. Specialty Mfg. Co., 744 Lincoln Hwy., Detroit.

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on pages 8 to 26

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More Money Making Opportunities on pages 8 to 26

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More Money Making Opportunities
on pages 8 to 25



How to Discover and Correct Your Weak Points

What is holding you back? Is your mental engine missing on at least two cylinders? A Pelmanist's brain hits on all six. A Pelmanist is alive. That is why over 650,000 of them are climbing the hills of Business "on high."

OVER ten million Americans drive cars, and they all know that they can't expect full, maximum power and speed from an engine that is "missing," or choked with carbon. The moment a "knock" or a "pound" appears, they have it fixed.

But thousands of these same Americans go around with their much more valuable brain-machinery groaning and creaking for lack of a little intelligent attention and care!

They try to make the grade of success with the WILL-POWER cylinder not firing at all, or with a sooty spark plug in the PURPOSE cylinder. Or may be they are not getting the help they could from CONCENTRATION, OBSERVATION, IMAGINATION, or MEMORY. And the worst of it is that they don't know where the trouble is! They just go "knocking" and "hammering" along through life, wondering why they can never catch up with any of the BIG rewards that always keep disappearing just 'round the turn of the road ahead.

Only a "well-tuned" brain gets

Perhaps you have the idea that you lack WILL-POWER. So you set out to develop it. But, even if you succeed, it isn't going to bring you the rewards you want—not all by itself.

You also need keen OBSERVATION to see opportunities, lively IMAGINATION to make use of them to your advantage, steady CONCENTRATION and strong MEMORY to solve the problems sure to arise, and, most of all, an indelible PURPOSE to accomplish your desire.

Think of the man or woman you admire most for achievements, and see if this person is weak in any one of these faculties. It is more than likely that he, or she, has a well-tuned brain engine—running sweetly along—always giving maximum power and speed—always getting the most out of life.

This is the ideal of Pelmanism, but nearly a million happy Pelmanists in all parts of the world are living witnesses to the fact that Pelmanism is more than a mere beautiful ideal.

It is actually a process for tuning up all the mental faculties and making them work together for the greatest self-development possible to each Pelmanist.

That this wonderful system is both practical and fascinatingly easy to learn is proved by the thousands of enthusiastic endorsements that the Pelman Institute is constantly receiving from students of Pelmanism.

Here is what Mr. Ray P. Hovey, of San Pedro, California, writes:

"I have put the Pelman course into practice by going after the things I needed for active advancement. I have built a new home for my wife and family. I have developed a

opportunity. He sees it in places where the average eye sees nothing. Proper training has sharpened his observation and a "his eyes were opened." He has a purpose in life and he knows he can achieve his aim. His concentration and imagination are strong; his will is powerful—in a word, he is "captain of his soul!"

Learn the "team-work" of the mind

Lack of space prevents mention of all the benefits Pelmanism can bring into your life—as easily and certainly as the sun rises. But the Pelman Inst. has prepared a free book that will really startle and amaze you. It shows how and why Pelmanism is the only system of teaching ever devised for developing all the mental powers at the same time.

Whether this brief glimpse of Pelmanism has attracted you or not, whether you're that "so weak or lacking in some valuable mental attribute, or not, you should at least send for this remarkable record and outline of Pelmanism—its action, achievements, and its boundless possibilities.

Send Now for This Free Book

Pelmanism actually gives its students "New minds for old"—and it does this not by any magic, through a method to select, fix, and keep that you look forward to each new lesson as you would to a pleasant evening at the theater.

You do not outgrow yourself in any way by sending the coupon below, but it will bring you a copy of the astonishing free book that explains Pelmanism from start to finish and gives a wealth of the most convincing, voluntary letters from Pelmanists, showing how this remarkable mental revolutionized their lives and fortunes, sometimes increasing their earning capacity.

One of our most successful students writes that he sent for this free book "through mere curiosity." But he also writes that Pelmanism "has made another team of me" and that making the course "the best use of our advertisements was 'the worst act of his life'."

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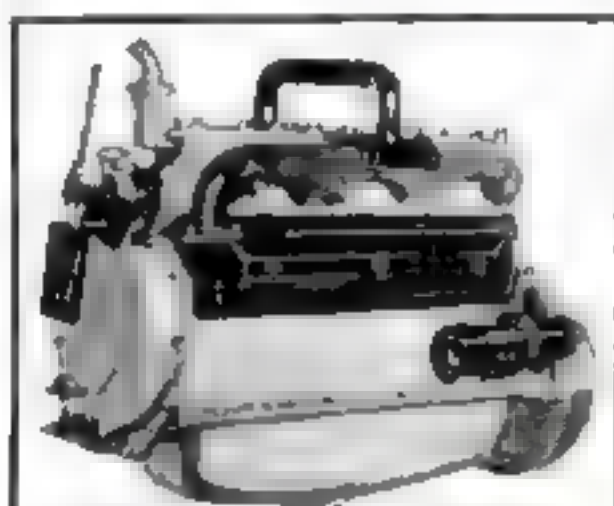
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taste for study, and broader lines of thinking and reading; and have secured a position much more adapted to my best experience and capabilities. I feel a thousand times repaid for starting the course."

Mr. A. Gillespie, Vice-President, of Cluett, Peabody & Company, manufacturers of Arrow Collars, says:

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And Mr. C. B. Clafin, a merchant in Philadelphia, Pennsylvania, sums it all up in the words:

"I have practically revolutionized my life by taking this course."

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Linger Awhile
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Mamma

These Wonderful New Waltzes

Sleep
Cielito Lindo (Beautiful Heaven)

These Great New Song Successes

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If the Rest of the World Don't
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You're In Kentucky, Sure As
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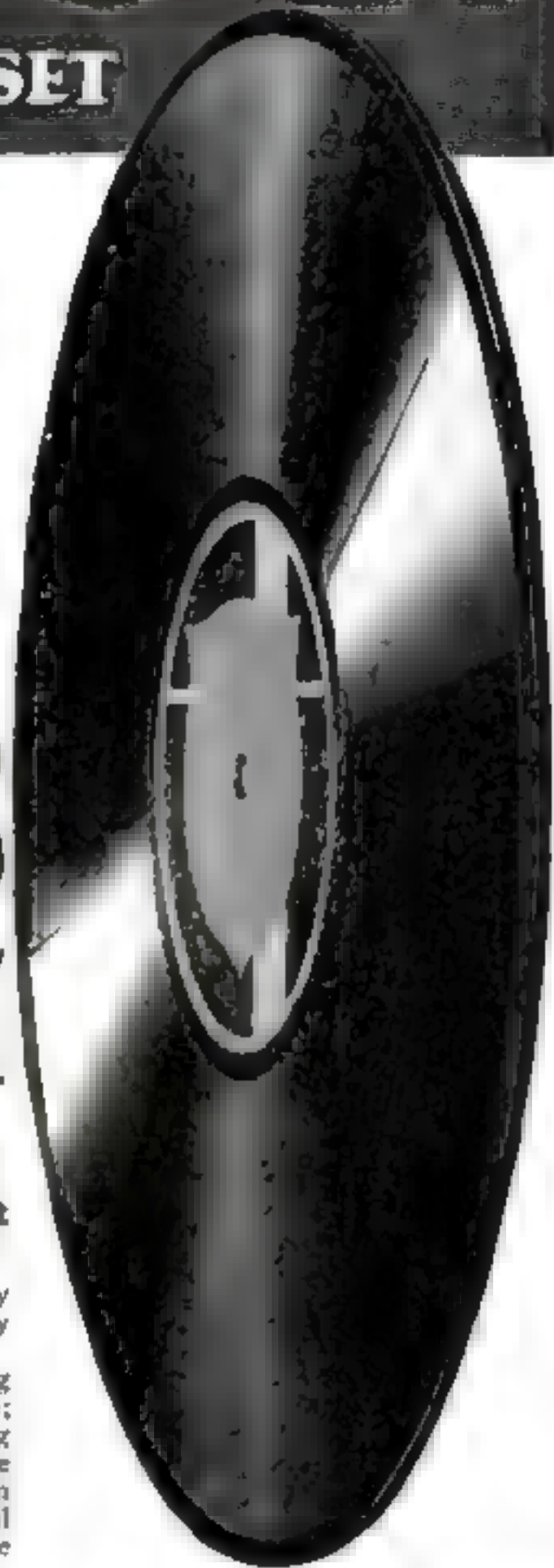
If you like the great songs from Grand Opera you may also care to have four of the most popular ones ever written. La Donna e Mobile from Rigoletto, Mollie of Haverford from Haverford, The Carpenters and Soldiers' Chorus from Faust. All beautifully sung by great artists, with full orchestra. If you care to have these Grand Opera Songs, in ADDITION to the set listed above, place an X in square at left. The price is only 15c for all four selections. SOLD ONLY with the set advertised above—not sold separately.

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Machines that Mark New Aerial Progress

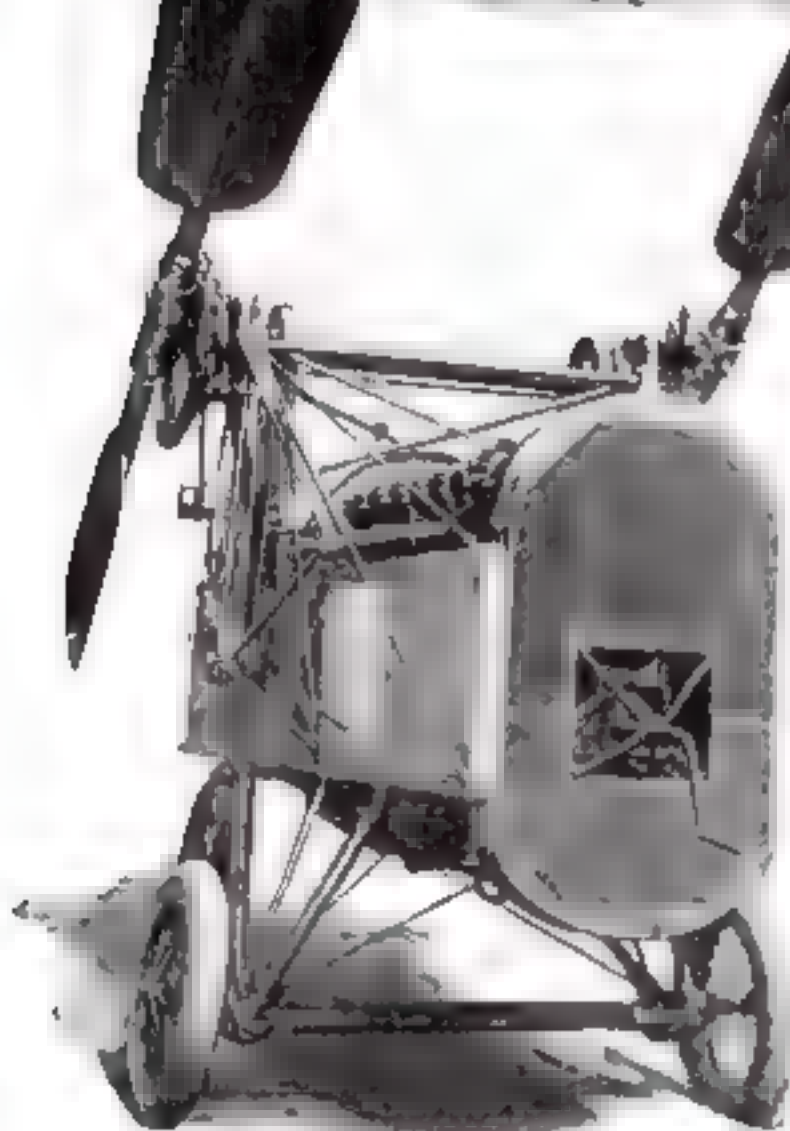
Giant Airplanes and Odd Helicopters to Conquer the Skies



THE LAST WORD IN NAVAL AIR ARMAMENT is the huge torpedo-carrying airplane shown in full flight above. The machine, a Vesper biplane built for the British navy, is said to represent a reduction in size, as compared with other types without in the least sacrificing load capacity.



THIS IS THE WORLD'S LARGEST HYDROPLANE, recently completed at St. Raphael, France. The machine is a huge double biplane weighing 10 tons and driven by two motors of 1900 horsepower each. The great streamlined body is a spacious air coach handsomely furnished for passenger transportation. This body is built on a broad pontoon capable of riding the waves in the roughest weather. Note the unusual arrangement of the four wings in pairs.



ON AV

THE LATEST CONTESTANT for the \$250,000 British Air Ministry prize. The machine, a practical vertically rising machine, is the Conquestor pictured above. Its two side propellers are designed to imitate the movement of a bird's wings. The inventor, E. P. Johnson, of Chicago, claims it will fly backward or forward.



A HELICOPTER BUILT ON AIRPLANE LINES has been designed by William J. Beach, author inventor of Australia and New York City who is shown above demonstrating a small model of his invention. The upward movement of the strange machine is said to be produced by revolving planes acting on a series of four shutter-like planes that stabilize the machine.

Built to Grace a Drawing Room



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Type R-44
Complete with R-440
Tuning Knob \$175.00
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Type R-44
Complete with R-440
Tuning Knob \$110.00
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Perils of Polar Flight

*For want of a nail the shoe was lost,
For want of a shoe the horse was lost;
For want of a horse the rider was lost—
All for the want of a horseshoe nail!*

ARTIC exploration is just like that. One tiny oversight, one nail or bolt or lacing missing at a critical moment, and the lives of daring men may be needlessly sacrificed.

No military campaign ever was planned with greater attention to detail than that of the Polar Air Expedition which the United States Navy announced for the dirigible *Shenandoah*.

Lessons of the Past

After more than a century of international effort, stippled with tragedy and crowned by Peary's superb achievement of the North Pole, we have come at last to know the incredible complexity as well as the unavoidable peril of polar work.

Consider the field of action. On the American side Nome is the most northern place available for a base. Point Barrow, Alaska, for instance, is not open until August. And ice conditions are so uncertain there that a ship could not stay long enough to be of real help to an air expedition. Somehow we think of Alaska as having the North Pole in her back yard, so to speak. Yet it is 1560 miles from Nome to the earth's apex!

Fierce Arctic Winds

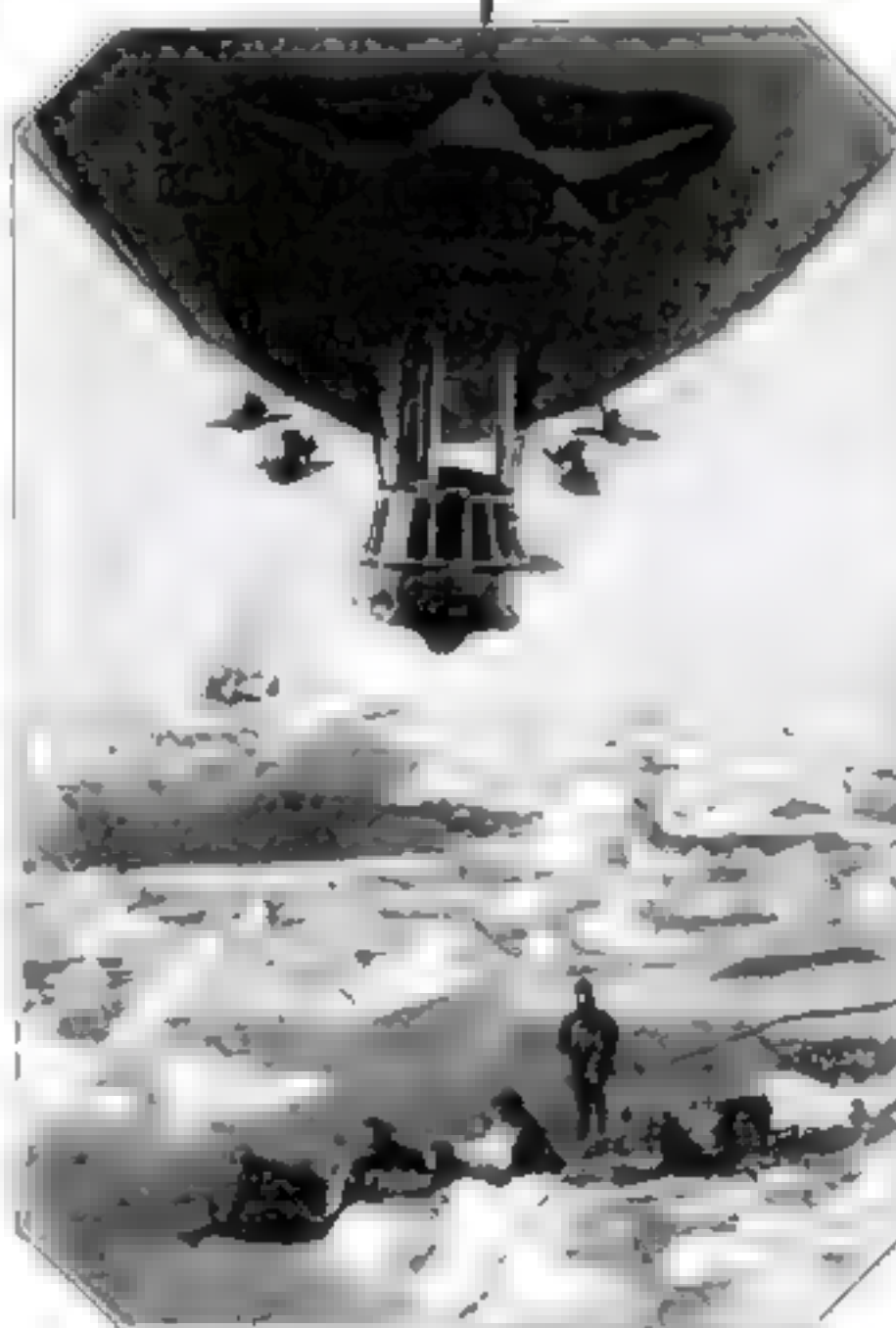
Twice 1560 miles is more than 3000 miles. If an airship has a cruising radius of 4000 miles she theoretically can fly from Nome to the Pole and back with safety.

But a cruising radius is figured for still air. And Bering Strait is a veritable funnel. Cold northerly winds pour through it for weeks at a time. If the wind blows 40 miles an hour against an airship and the ship is making propeller revolutions for 50, her advance over the ground is only 20 miles an hour. With such a handicap the Nome-Pole flight would become proportionately 9000 miles! No airship ever designed could tackle such a journey.

How Our Navy Experts Are Preparing for Conquest of Far North by Airship

By Lieut.-Colonel Fitzhugh Green, U.S.N.

Member of the special Naval Arctic Air Board appointed to supervise the "*Shenandoah*"'s cruise over the Pole



In addition to all the icy terrors that in the past have confronted explorers in their daring and often disastrous attempts to reach the top of the world by ship, the dog teams the crew of an airship must be prepared and fully equipped to meet new and unaccounted perils in an attempted polar flight. Buffeting air currents swirl about the Pole. Projecting mounds of ice make the landing of an airplane hazardous and the landing of a dirigible out of the question. The composite photograph above vividly illustrates these hazards.

The point I wish to emphasize is that the Arctic is a vast place—something more than 8,000,000 square miles in the polar basin, one third of which is totally unknown! Enormous distances must be covered. No bases exist save those

any that will be encountered on the coming expedition.

The thing about arctic cold is its persistence. A recording thermometer on the Polar Sea in any summer month will show about 30° F. day after day with but a

especially established. Wind conditions are little more than a guess. Hence, months of preparation in a myriad minute ways are essential for a final sally against the demon blizzards of the north.

The practical purpose of an air expedition northward is two-fold. First, exploration of the unknown area of the Polar Sea north of Point Barrow. Second, establishment of the practicality of a transpolar route between Europe and Asia, with resulting trade advantages.

To Seek Unknown Land

The first objective is the so-called "Pole of Inaccessibility." This is the center of the unknown area lying about 600 miles north of Point Barrow. Systematic flights over it either by plane or dirigible will determine whether or not land lies there.

The second objective is not only the accomplishment of a transpolar flight, but the collection of aerological data that will enable American commercial enterprise to enter this field with some idea of the feasibility of an arctic shortcut to Asia and Europe. Such accomplishment is in line with the peacetime uses of our naval forces. In like manner the Navy operates two ships engaged in scientific research for the Bureau of Fisheries.

Cold the Least Obstacle

Strange as it may seem, cold will be the least of all obstacles. Arctic temperatures are no more intense than those often experienced in our northern states. For five weeks in summer much of the Arctic receives more heat to the square mile than that received at the equator! Our Weather Bureau reports show that a temperature of 100° F in the shade has been recorded in Alaska! Airplanes already have been flown in temperatures far lower than

25524

ENTIRE SHIP GIVEN NEW COVERING
OF GOLD BEATERS SKINVERTICAL STEERING
RUDDERSHORIZONTAL ELEVATING
RUDDERS

Science and Chance Play for High Stakes at the Top of the World

ONE important point to bear in mind in connection with the proposed polar exploration by dirigible is that in any case such an expedition can never be merely a spectacular feat of dashing adventure. It is essentially a useful undertaking of exploration, which if successful, promises results of tremendous scientific and commercial importance.

In the accompanying article, Commander Green depicts vividly the almost unbelievable difficulties of arctic flying. He describes specific measures of the Navy to foresee these difficulties as far as possible before undertaking any flight as spectacular as has been proposed for the *Shenandoah*. Yet Uncle Sam's aviation experts know well that an infinite number of obstacles lie in wait for the forthcoming attempt to conquer the fierce air currents that swirl about the top of the world—obstacles that cannot be anticipated, nor guarded against by the most careful prepa-

ration. These unknown foes, as Commander Green points out, are reared by Chance, upon whose bounty those who dare the air in dirigibles are absolutely dependent for their success or failure. Witness the recent appalling disaster to the giant French dirigible *Dixmude*.

To be sure, the *Shenandoah* gave a splendid account of itself when it broke away recently from its mooring mast at Lakehurst, N. J. But such a ship cannot land as an airplane can. If its supply of fuel gives out, it is at the mercy of capricious air currents to a greater extent than even a balloon would be.

Maneuvering a dirigible near the ground is known to be virtually impossible. With helium gas supplying the lifting power, as in the case of the *Shenandoah*, great heights cannot be attained, because helium, expanding in rarefied atmosphere, would cause the

bag to explode. That is why the Navy's plans for the trip have been shaped so that she must circle the United States on her way to Nome; she cannot ascend to heights sufficient to clear the mountains that lie in the path of a direct route. The theoretical cruising range of a dirigible, as Commander Green points out, is reduced appreciably in any but calm air. In other words, Chance plays a not unimportant part.

So the crew of the *Shenandoah*, if they start on their voyage over the frozen seas of the north are facing all the dangers that ever confronted a polar expedition, plus unknown and uncounted dangers. They will be adventuring quite as much as the pioneer polar explorers whose expeditions almost invariably resulted in disaster.

The whole world will wish them success, but the world must not be carried away by the glamour that surrounds their hazardous and daring adventure.

degree or two variation on either side.

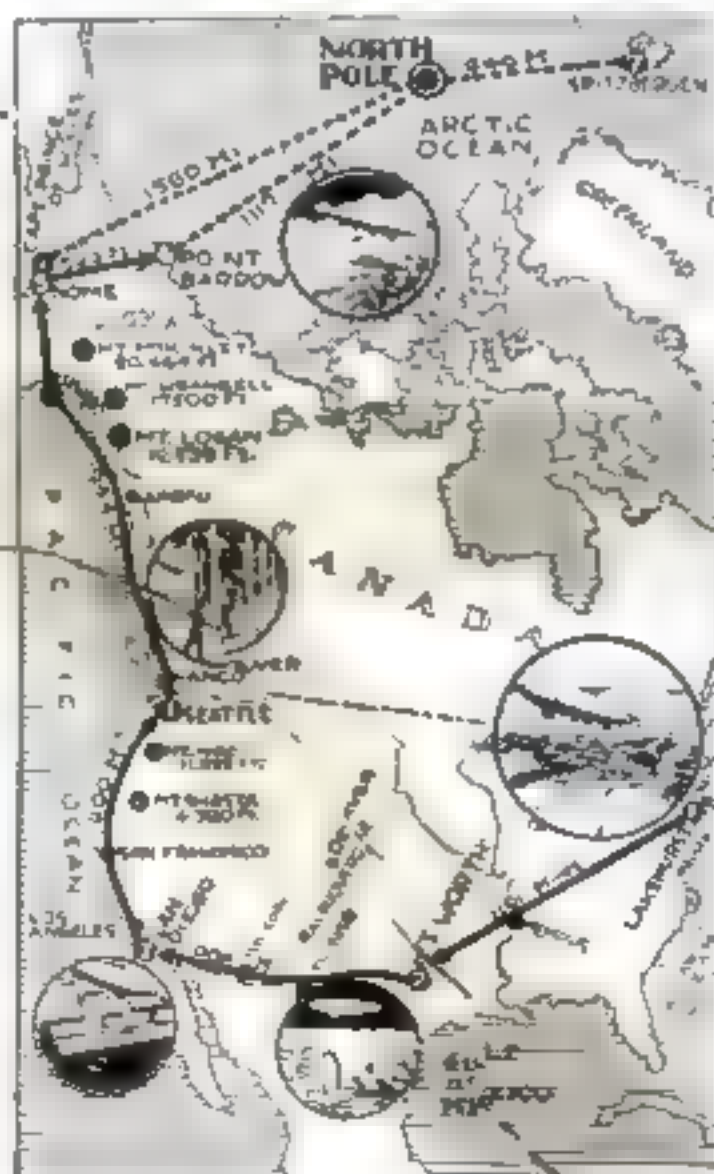
"We never seemed to get thawed out!" exclaimed a friend of mine who has done some flying in Spitzbergen.

Coupled with unvarying low temperature is the uncomfortable dampness of the arctic summer air.

Both of these features have a bearing on the choice of equipment for the expedition. Lubricating oils must be light enough, yet able to stand exposure to severe cold in case any engine is forced to remain north through the winter. All metal parts and fittings must be surfaced to withstand the effect of the air's high moisture content.

In allowing working time for such tasks as erection of mooring masts, hangers, and for repairs, a certain percentage always must be added for the numbing wind in which the men must labor. A freezing temperature is not severe. Often our carpenters work outdoors in colder weather than that. But in the north, where the sun's angle is low, where the cold wind's searching fingers never cease their prying, and where there is no such thing as noontime warmth, outdoor work becomes a serious problem indeed.

The aviator, confined to his narrow cockpit or control car, is supplied with special garments. Next to his



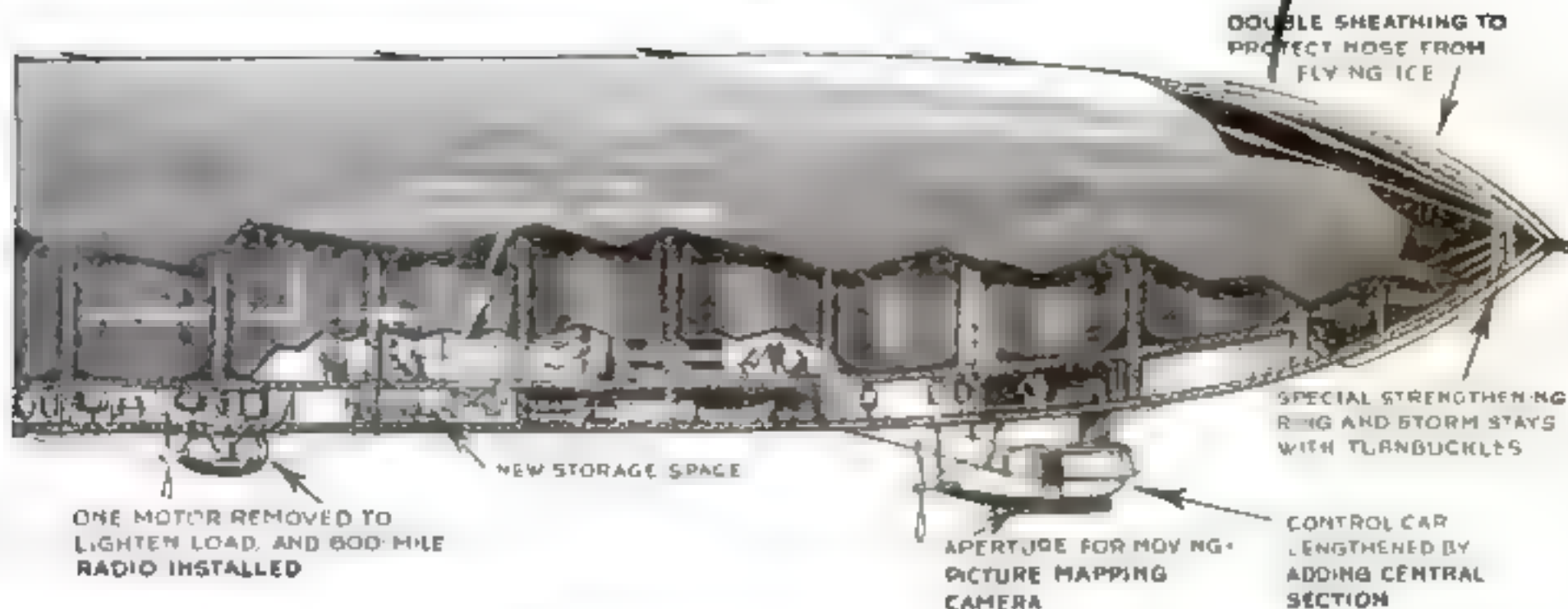
The contemplated route of the *Shenandoah* from her barge at Lakehurst, N. J., to her proposed Alaskan base at Nome, thence 1560 miles to the North Pole. The total distance from Lakehurst to the Pole over this circuitous course is 6900 miles.

skin he wears ordinary woolen underwear. Then comes an electrically heated suit of asbestos-like material. Outside he wears a closely woven windproof coat of burberry or skin.

But cold can be anticipated. Wind cannot be. Winds are caused largely by heat. At the equator hot air rises and flows northward. Speaking broadly, in the arctic regions it cools and somewhere over the Polar Sea falls and pours south again. Theoretically it might thus be possible to fly high and have a fair wind to the Pole; then, by coming down near the earth's surface, to have the wind aft coming back.

The trouble is that we don't know just what to expect. The atmosphere at the poles is oblate or flattened, just as is the earth, only immensely more so. That is to say, while the atmosphere over the equator is thrown out by centrifugal force, near the Poles the reverse is true, and the depth of the atmosphere is tremendously decreased. Hence conditions of flying near the North Pole at an altitude of 5000 feet may differ greatly from those found over the United States at the same altitude.

Shortness of breath is a common result of rising high above the earth's surface. Most aviators breathe through their mouths at altitudes



This diagrammatic cut-away view of the *Shenandoah* shows proposed alterations designed not only to protect and aid the great air cruiser in battling polar gales and ice storms, but to provide comfortable quarters and scientific equipment for the long cruise of exploration.

higher than 12,000 feet. At 15,000 feet the mere turning of the body to look around may aggravate breathlessness enormously. Since cold accentuates this respiratory weakness, it becomes one of the major problems of arctic flying.

One of the curious features of arctic navigation is the fact that the compass course toward the Pole from Point Bar-

row is a little south of west! The north magnetic pole lies in the North American archipelago above Canada. Toward it the compass needle points. Hence the paradoxical course that must be steered to reach the geographical pole.

There is a serious side to this matter. Static electricity is generally believed to be greater in polar regions than elsewhere

on the globe. The aurora depletes upper air conditions in this respect. Moreover, the directive force of the magnetic pole on the needle is slight in high latitudes. Altogether the compass is a frail assistant.

There are variations of the compass over the Polar Sea that never have been investigated. If a dirigible's navigator at the Pole should wish to head for Spitzbergen, 630 miles due south, he would have something to worry about when he began to set his course. Frequent sun observations would be his best bet. That is, if there were no arctic fog on the job to prevent him.

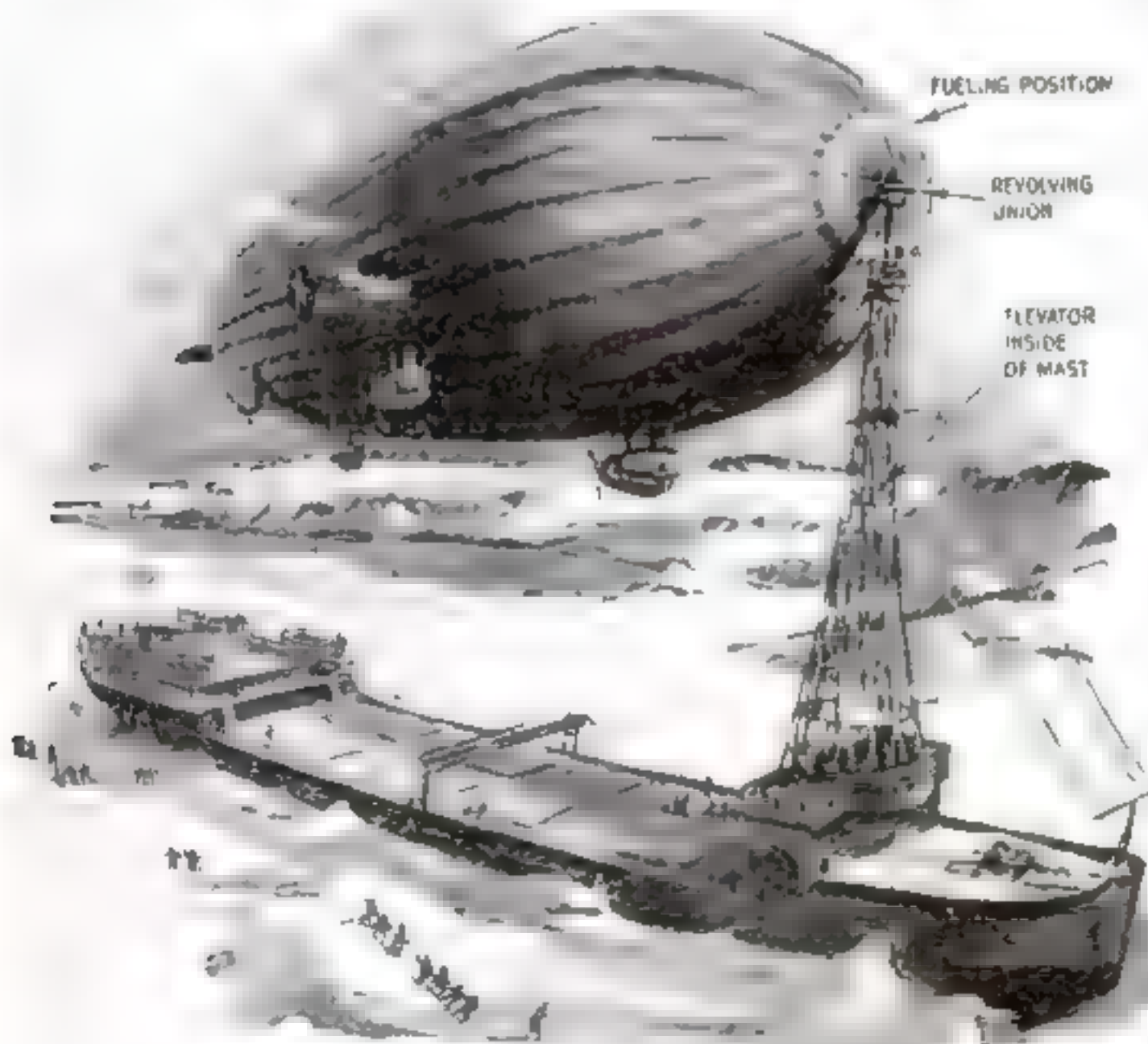
The thrilling possibility of the expedition is that we may find land. We must be prepared to find it, at any rate, and this opens up a whole new list of troubles.

Dangers of Landing

Take the airplane. To fly safely over the polar pack a plane must be equipped with pontoons for landing in the water that forms on the ice in summer, or in the open water between floes. On these pontoons must be runners for landing on ice or snow, if

so far so good. But every arctic traveler knows that visibility conditions on the ice pack in broad daylight often are so trying that even a man afoot constantly stumbles over projecting nubbles. Diffused rays of the sun and lack of shadows make the roughest ice-field look smooth as a table from an altitude of 500 feet. To land under such conditions would mean to wreck one's plane.

A dirigible is even more severely handicapped. At the present point of progress in this form of airship, a safe
(Continued on page 150)



To provide dirigible anchorage in the Far North, the Navy is developing this type of mooring mast to be carried by supply ships. In its construction the lessons learned when the *Shenandoah* broke away from her mooring mast are being utilized.

The mast will be built to withstand an end-on pull greater than that produced by the 70-mile gale at Lakehurst. It will be equipped with elevators for the crew and pipe lines for water and gasoline. Motor winches will carry heavy loads up to the ship.

"My Fellow Scientist—The Rat"

An Interview with Dr. E. V. McCollum, Famous Authority on Diet

By Norman C. McCloud

DR. ELMER V. McCOLLUM, professor of biochemistry at Johns Hopkins University, is one of the world's leading authorities on food and diet. He set out some of the things that human beings should know, as Dr. McCollum asked me. How was the rat faring? He answered by the fact that the rat had gained credit for having a better figure to determine the effects of food on the body.

Advanced Food Science

But Doctor McCollum is not yet satisfied with the results of his work. He is still experimenting with rats, and with their aid he will establish new principles of nutrition, which it is safe to assume, will mean a longer, happier life for you and me. His laboratory-workshop at Johns Hopkins University in Baltimore is the seat of epoch-making revelations. In matters of food he is an investigating pioneer. To visit him is to have a glimpse of the show-window of advanced food science.

Rats play an important part in the story of the life and works of this scientist. They scamper through the tale as through a chess shop. In the contest with mice for this distinction the rats triumphed because of their dignity. A mouse is frisky and uncompromising, a rat is gifted with poise and understanding. It is because of this superiority that McCollum has been able to make rats his fellow workers in scientific discoveries.

A Laboratory Full of Rats

In his laboratory are hundreds, sometimes thousands, of them. Cages in rows line the walls and the floor, each heavily screened. Here and there the quick flitting of a tail shows that a cage is occupied. He feeds his rats with this food and that, observes the effect on them, and then translates his conclusions into terms of food for human beings. By regulating the diet of his rat associates, Doctor McCollum makes them sick or well, small or large, thin or sleek, contented or ill-tempered. By what may be called improper feeding he can make a rat prematurely old, and by proper feeding can make it retain the characteristics of youth.

These things he has been doing for about 13 years. During this time he has been storing up valuable facts relative to the effects of various foods and animal



Dr. Elmer V. McCollum, world-famous authority on food and diet, at work among his rat cages in his unusual laboratory at Johns Hopkins University. In hundreds of experiments with rats he has learned much concerning the influence of food on the bodily welfare of the animals, which he has translated into terms of the human body. These results have thrown important light on the food requirements of human beings.

organisms. These, formulated into general principles regarding human diet, he expects will lead gradually to a longer, healthier life for mankind.

"As a research assistant, the rat is an animal after the experimenter's own heart," he told me. "Gentle, easily handled, and amiable, the rat may be weighed in five seconds. Keeping his record is a simple undertaking. Other factors in his favor are his rapid growth and a generous number of offspring, two points of importance in the study of food consequences. With the rat we are able to carry on what amounts to cross-examination. Giving him food of known elements, we can ask him whether it is satisfactory and demand that he answer 'yes' or 'no.' The animal quickly answers by his growth or his lack of growth.

"In this way the rat is just as accurate as the chemist's beaker, although some chemists are inclined to scorn the use of the animals as lacking the charm of working with crystals and chemical formulae. Call him a laboratory animal or an animal laboratory, as you please, the rat is an ideal fellow scientist."

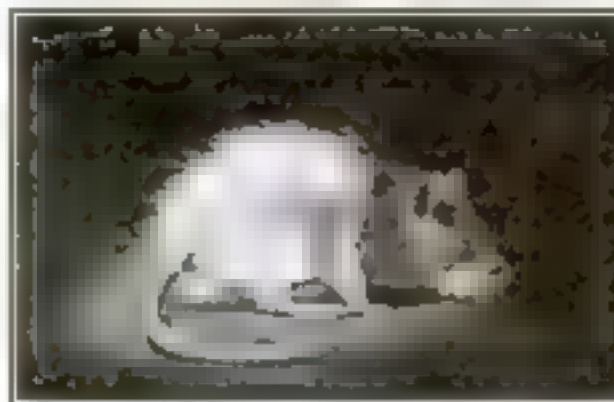
What Diet Does

Some of the physical conditions produced in the rats, simply by regulating their diet, are amazing. Thus a diet containing every element necessary to physical growth except proteins—which man takes mostly from meats—causes a growing rat to become dwarfed. A later change in the diet to include the element formerly lacking will result in growth.

Regulation of the diet will make a female rat barren. It will even destroy the mother instinct and cause the mother rat to attack and kill her young. This is an especially remarkable demonstration of the effect of food on animals, since the mother instinct in rats is very strong.

Departures from the normal diet is found to produce diseases of various sorts—nervous, as well as physical. They also will cause a year-old rat, which should be in prime vigor, to take on the aspect of an aged animal of three years. One experiment that Doctor McCollum has performed repeatedly will suggest an analogy in human life. Two groups of rats of the same age, one fed on an adequate diet, the other on diet insufficient in some particular, apparently will thrive equally for a while. After six months or so, though, the rats insufficiently fed will begin to fail. Nervousness and irritability, bodily emaciation, then death will be their portion, while the other rats will remain plump, strong, bright-eyed, and serene until old age comes upon them.

In one cage I noticed a decrepit, gray



One ingredient dry whole milk made all the difference in these two rats both of which were 300 days old when photographed. In other respects their diet was the same—bolted wheat flour, degerminated cornmeal,

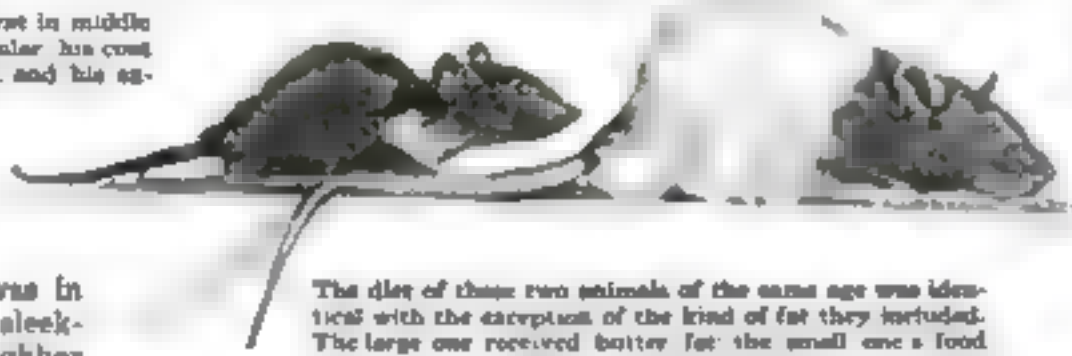


cooked and dried potato, peas, navy beans, beets, turnips and beefsteak. The puny, prematurely aged rat at the left lacked the milk diet. The other receiving the milk, grew much larger, retaining youth and vigor.

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24884



Above: A well-nourished rat in midlife. He is sleek and muscular, his coat is smooth, his eyes bright and his expression contented. Animals such as this one never attempt to escape or to bite, says Doctor McCollum.



The diet of these two animals of the same age was identical with the exception of the kind of fat they included. The large one received butter for the small one a food was made up with vegetable oil in its preparation.

Here is a little bow-legged rat suffering from rickets caused by faulty diet. By experimenting with rats, Doctor McCollum is making the cause of rickets, a disease of malnutrition from which 50 to 75 per cent of all children in the world are said to suffer.

old rat whose senility was in striking contrast to the sleekness and virility of his neighbor in an adjoining cage.

"I suppose you are about to retire this one," I remarked, pointing to the gray rat. "He must be the ancestor of them all."

"On the contrary," said Doctor McCollum. "That young-looking rat is a year old and is the father of the ancient-looking rat, which is just four months old."

Here indeed was a striking example of what this remarkable scientist is accomplishing by means of diet!

Just now Doctor McCollum, with the cooperation of Dr. P. G. Shipley, is deeply engrossed in the study of bone growth, with particular reference to the prevalence of rickets. This disease of malnutrition is one of the tragedies of childhood. From 50 to 75 per cent of all children are declared to be afflicted, and for this reason a solution of its cause and prevention would become one of the master contributions of research to the human race. The work promises to take years, but the true scientist views such a prospect undismayed—and McCollum is the true scientist.

Some of his most important recent work has been along the line of the relationship of food to the kidneys, in an effort to determine what nutritive factors are involved

in the progressive loss of the kidney functions with advancing years. Results place the blame on what the scientist designates as high protein content of the diet, which the rest of the world understands as the eating of too much meat. In this research Doctor McCollum has brought to light much that is new and important.

Doctor McCollum will take a slice of steak, a dish of beans, or a ham sandwich and analyze it to the last atom of its possible effect on the human body. He can glance at the dinner table of his hostess and tell from the food spread before him precisely how much the meal offers in nourishment, energy, and well-being.

As a scientist he is exactness itself. But he does not believe in making the dinner a matter of multiplication and addition—a problem in mathematics.

"It seems useless to me," he said, "to tell the housewife that she must give her family this number of calories and that percentage of various vitamins. It is unfair to expect her to figure that there are 600 calories in a certain steak, 400 in a given amount of liver and bacon, and 300 in a specified weight of spinach. To do this is to expect her to sit down with pencil and paper and figure out for herself by mathematical rule the various dishes that constitute a well-balanced bill of fare.

"In this connection I am convinced that the planning of the meals is of itself a task of which the housekeeper should be relieved by science, and for that reason I have tried to do the work in her stead. In that theory lies the explanation of my book, 'The American Home Diet,' prepared with the collaboration of my associate, Miss Nina Simmons."

Yearly Bills of Fare

To do away with multiplication, subtraction, and long division in planning meals, Doctor McCollum has given the housewife a bill of fare for three meals a day for every day in the year. The important fact is that he has done all the mathematics in his own laboratory, with the assistance of his rats. These bills of fare are convincing. They show that a scientist may be a human being along with his intimate knowledge

of our digestive workshops. This is proved by the readiness with which he prescribes the things we like. His sole aim is to see that we eat these foods in proper proportions. The McCollum bill of fare is not a diet. It is simply a well-balanced ration, seeking to give the proper fuel to the human engine.

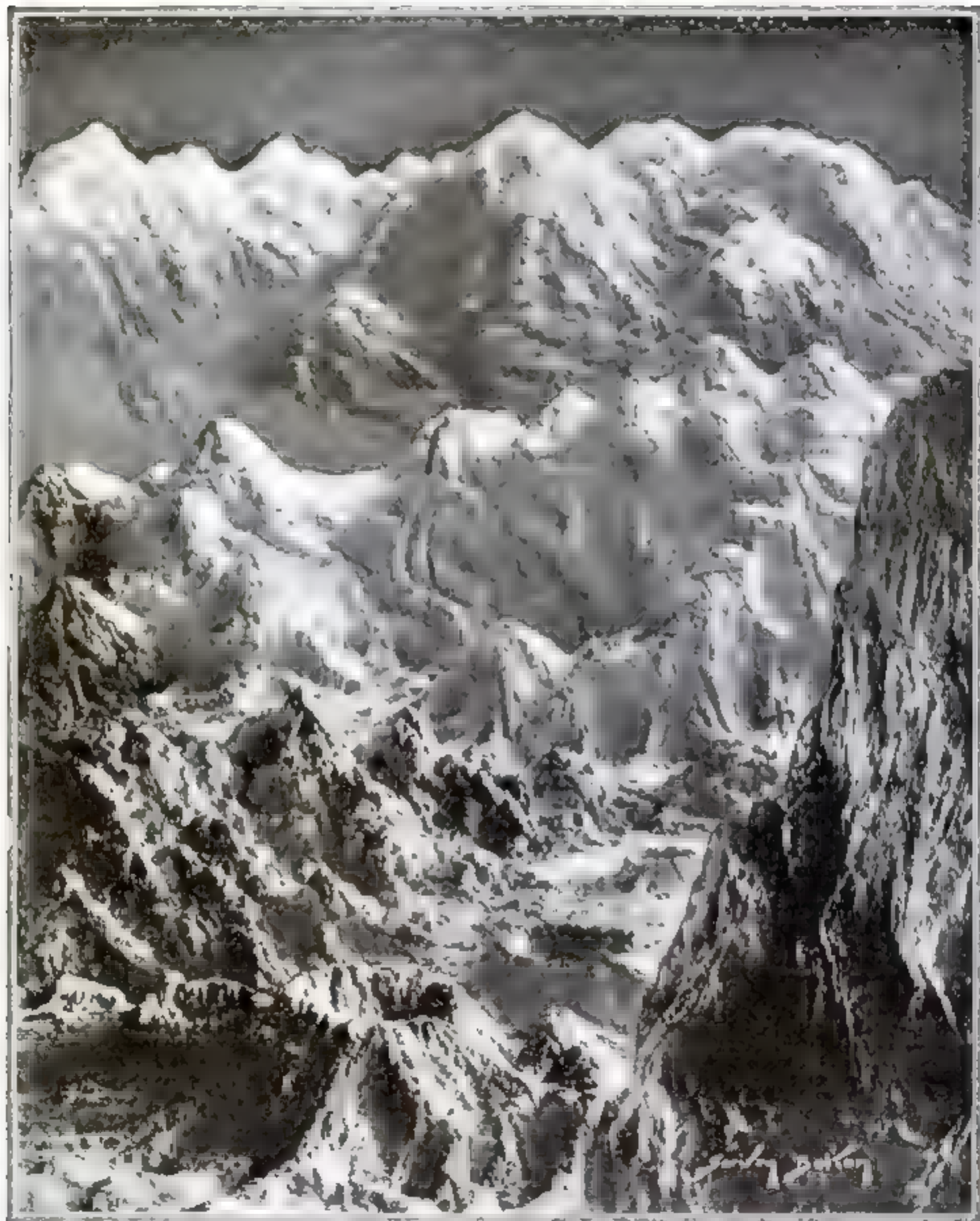


How the eyes are affected by insufficient food. The views at the left show the appearance of normal eyes in the rat. The middle views show the eyelids affected by a disease due to lack of certain fatty foods. At the right are shown the swollen condition in late stages of the disease.



This little fellow is showing the first symptoms of a nerve disease called polyneuritis, similar to beri-beri in man, produced by a diet deficient in certain vitamins. Note the tense attitude.

Snow-Clad Peaks of the Moon's South Pole



THIS remarkable picture, based on actual astronomical photographs of the South Polar regions of the moon, indicates that the lunar poles like those of the earth, are covered with snow. At least, that is the theory accepted by most astronomers in explanation of the fact that the poles of the moon are lighter in color than any other regions of its area.

Since the surface gravity of the moon is very weak, water cannot exist there in the liquid state, hence, the

inference that it is converted into hoarfrost, ice, and snow is natural.

The geographical position of the pole is marked by the majestic mountain range shown in the background, known as the Leibnitz Mountains. One rises to an altitude of 36,000 feet or 7,000 feet higher than the earth's loftiest mountain, Everest.

This picture is a photograph of a model of the moon's South Pole executed by Scriven Bolton, F.R.S.

Why Our Habits Make or Break Us

Another Illuminating Chapter in "The Story of the Mind"

By James J. Walsh, M.D., Sc.D.

ONE of the most significant stories I ever heard was told to me not long ago by a New England manufacturer.

A middle-aged man for several years had been a department head in the shoe factory where he had been employed since boyhood. A new concern offered him an opportunity to take charge of its factory at a generous salary, and he accepted.

His term of service at the plant where he had passed his entire working life came to an end on a Saturday night, and he was to assume his new duties the following Monday morning.

Force of Habit

When Monday morning came, the new manager, who, like most early risers, was accustomed to allow himself no more time than was necessary in getting from his bed to his work, hurried through his breakfast and rushed from his home to the street-car line just as he had been doing for years. The car he usually took was about to start from the corner as he approached. He caught it after a run, found a seat, and became absorbed in his newspaper.

Eventually he got off at a factory building, and hurried within. And not until he saw a stranger sitting at the desk that he had occupied for five years did he realize that, instead of going to his new position, he had walked straight into the



When deeply interested, Secretary of the Navy Edwin Denby presses his tongue between his lips; a mannerism habitual to many persons when paying close attention.

factory where he had worked all his life! Not only that, but the street car that had carried him there ran in a direction opposite to the one he should have taken.

Incredible though this story may seem, I find it entirely believable—an extreme case, perhaps, yet a wonderfully illuminating instance of the ruling power of habit in directing the activities of man. That factory manager was so accustomed to going to work at the same time and in the same way every morning that he unconsciously went through the same routine even after he had changed his place of employment.

You, Too!

We are all creatures of habit. You may not realize it, but most of the things you do are the creations of the habits you have formed. You are, in short, what your habits make you. Trivial matters, such as which shoe you put on first; more important things, such as the amount of sleep you take, the quantity of food you eat and the way you perform your work—all of these are the result of habit.

Through constant repetition you have so established a particular way of doing things that it has become entirely natural and instinctive, sometimes even involuntary and uncontrollable.

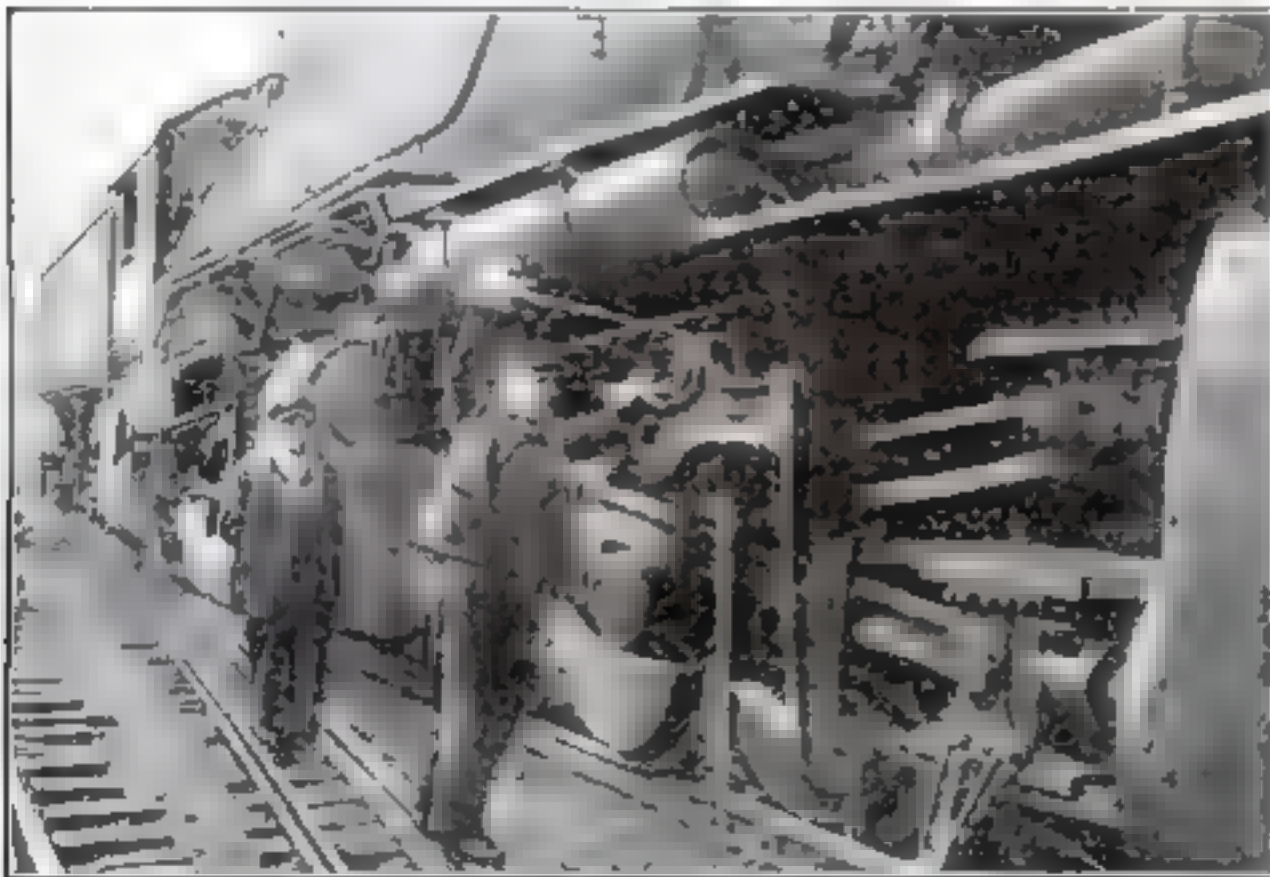
Constant repetition—that is the psychological explanation of habit. And while it is true that habits form your character, you, by constant repetition, can shape those habits for good or bad—for health, success, and happiness, or for failure and misery.

If you are driving a motor car and suddenly find it necessary to stop, you will apply your feet so swiftly to the clutch and brake pedals that your action seems instinctive. It is not instinctive, however. It is performed through habit—through constant repetition. When you first started driving, you will remember, you had to think of each of these movements separately and so performed them slowly.

"How Use Doth Breed a Habit"

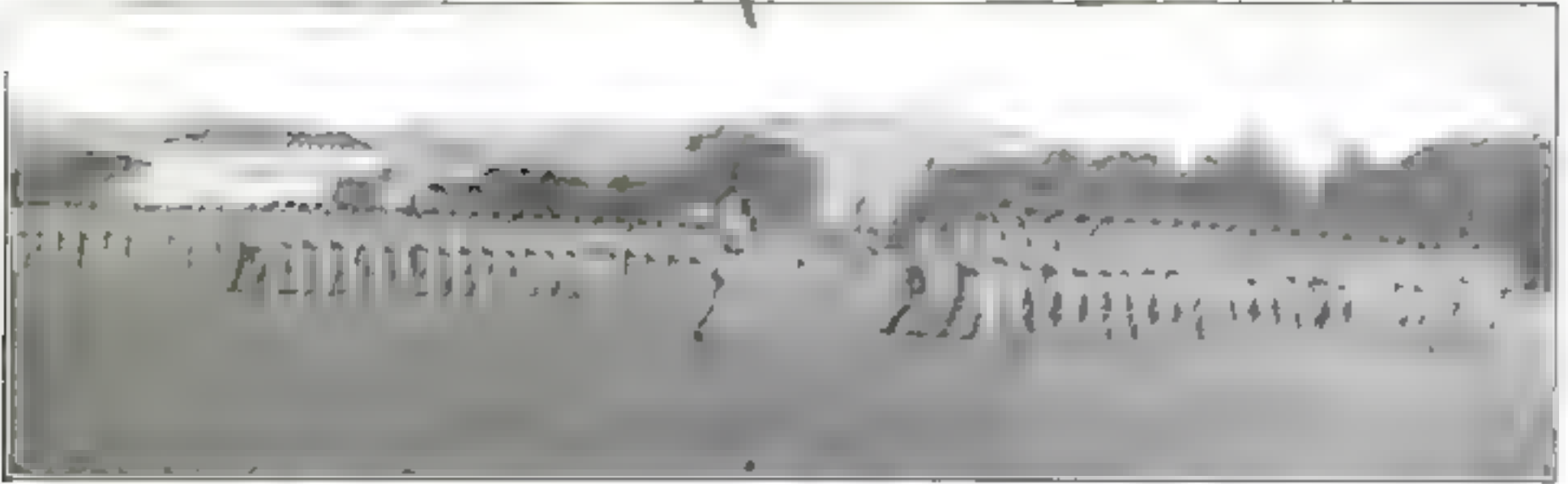
Even if you are not driving a car—are merely a passenger—habit may lead you to go through the motions of throwing out the clutch and putting on the brakes when the necessity arises for suddenly stopping. I know a motorist who was forced to give up long tours in the summer because of this habit of back seat driving. He always was as tired as his chauffeur at the end of the day's run.

Sometimes habits become so natural that without indulgence in them we feel ill at ease. I could name half a dozen men who actually cannot work unless they have a pipe or a cigar between their lips, even though they may not be smok-



The locomotive engineer has formed the habit of leaping from his cab and oiling the engine as soon as he reaches the end of his run. So

firmly is this habit rooted, that the action is performed involuntarily, apparently without conscious effort on the engineer's part.



Marching and drilling with marvelous precision, the West Point Cadets are a striking example of the value of habit in successful achievement of the most exacting work. By constant repetition they have formed the habit of always stepping out with the left foot. It has become "second nature" for tall and short men to take steps of the same length to preserve alignment of the ranks. All rifles are held at the same angle. Small points such as

these that combine to make the parading companies march as a single, rhythmical unit, were learned at first by painstaking effort. With the trained cadet, they have become unconscious acts. Similarly Doctor Walsh tells us profitable habits of health and industry that promote success in any field of endeavor can become so deeply entrenched in us that we shall find it almost impossible to perform an injurious or wasteful act

ing. And I know a lecturer who thrusts his right hand into his trousers pocket the instant he takes the platform, keeping it there throughout his talk. He told me once he would stammer like a schoolboy if he couldn't have his hand in its accustomed place.

What Are Your Habits?

Any number of public speakers have habits of interpolating a syllable like "ah" or saying "ugh" or something of that kind, and when they attempt to break themselves of it, they actually disturb their thinking and their speech. Such is the force of habit.

Such habits in themselves are trivial things perhaps, but they have an important bearing on our daily actions. If you work in a shop or large office, you will observe that every one of your fellow workers starts the day's work and proceeds each new task invariably with certain characteristic mannerisms. You yourself undoubtedly traverse the same path every day on your way to your street car, railroad train and office, walking always on the same side of the street, making your crossings at the same points. If you drive an automobile, it is almost certain that you always use the same roads or streets in traveling between two points, even though you may have a choice of other roads equally good. Unless you are unlike most other people, in chewing your food you use the teeth of one side of your mouth much more than those of the other.

Every one of these acquired habits is the result of repetition. The first time you perform an action, you find it difficult. You are awkward, and so it is necessary for you to consider each separate movement carefully before you make it. Each step is accompanied by a rapid-fire, more or less disordered interchange of nerve messages between your senses, your brain, and your muscles. The second time you perform the action, you find it a little

easier. There is the same interchange of nerve messages, but it is accomplished more smoothly; you have found out what lines in your bodily telephone system must be kept open for the exchange of messages, and you prevent interference from unnecessary calls.

The third time you essay the action, it is even more easy; the nerve messages travel back and forth with greater speed and surety; the necessity for attention is less. And, when you have done the thing a few more times, the exchange of messages is accomplished automatically, without conscious effort on your part. The action has become a habit—"second nature," as the phenomenon often is expressed. This is a particularly happy way of expressing it, too, in my opinion,

since nature so often takes care of us when we cannot take care of ourselves. Our habits—which depend entirely on ourselves—will take care of us if we see to it that they are of the right kind when we are forming them.

It is unfortunate that when habits are mentioned, most people think of bad habits, just as when we talk about passions, people conclude that evil passions are meant. As a matter of fact, every normal person possesses passions for good so strong that if he follows his natural inclinations, he finds it easier and much more satisfactory to do right than to do wrong.

These passions for good are ingrained in us. They are part of the inheritance of the race, evidence of a world force that makes for good.

Similarly with habits. Habits for good can be so strong that we will find it all but impossible to break away from them and perform an evil action. I do not mean "evil" in a moral sense necessarily. What I mean is this:

Training Yourself

You can make it a habit to work so industriously that idleness will be irksome and painful to you, with the result that your constant efforts will carry you on to success.

You can make it a habit to eat plain, wholesome food, to chew it thoroughly, to exercise, to bathe frequently, to breathe fresh air and get plenty of sleep, and thereby insure your health.

You can make it a habit to be thrifty and frugal, and so prevent the specter of want from hovering above you in old age.

All of these habits you can acquire through your own efforts and only through your own efforts. Moreover, because your body falls so readily and rapidly into modes of action that become habitual when repeated, the effort required will be less and less as



Is it your habit always to point with your right hand? You could point with your left hand just as well, but you would not do so unconsciously as you do with your right through constant repetition.

time goes on. In fact, it is necessary to do no more than to make a good start. After that, Nature carries on the work for you, and at last the habit is ruler and can be broken only by a determined effort.

No principle more useful than this has been developed by the science of psychology. I might almost say that once a man understands the ruling power of habit, he has learned everything of practical value that psychology offers him; that he holds in his hand the key that will unlock the storehouse containing the hidden powers of his mind. For when he reaches the point where habit performs most of his daily routine of activities, his mind is left free to occupy itself with the other more important concerns that will lead him on to greater achievements.

Habit and Instinct

A simple illustration will serve to make clear how habit takes the place of instinct, how it causes the body to perform an action without our being conscious of the guidance of the mind. Undoubtedly there is a flight of steps in your home that you have walked up and down many times. Unless your habit of observation is unusually well developed, you cannot tell me how many steps it contains. Yet you can ascend and descend it in the dark and never fail to know when you are about to step to the upper or lower landing. I do not mean that you can *feel* the landing when your foot touches it, but that, when you reach the last step, you know—seemingly by instinct—that you are about to step from the stairway.

This is not instinct, though. It is the result of habit. Although you cannot state the precise number of steps in the stairway, your mind knows from previous experience exactly how many there are, and so accurately guides your muscles in carrying you up or down. It is possible even for you to carry on a conversation with some one while walking up a familiar flight of stairs in the dark, and, though you may be giving full attention to your talk, habit will guide you safely to the top.

A few minutes after you have gone to bed at night you cannot recall having wound your watch, yet, if it is your habit to do so upon retiring, it is almost certain that you will find you have done so if you get up to investigate.

Example of the

strength with which habits take hold and the difficulty with which they are broken is furnished to all of us who live in places where "daylight saving" is put in force during the summer. When the period begins, we suffer acute hardship getting up an hour earlier in the morning, and we

never will notice these sounds unless their attention is specifically called to them. All of these are examples of the amazing force of habit.

Take pencil and paper and try to copy a simple drawing, say the head of one of the characters in a newspaper comic strip.

You find it difficult, even if you have had some practice in drawing. You must stop again and again to refer from the model to your drawing. Yet you can write a long letter without ever giving a thought to the manual dexterity required in forming the letters, which are quite as complicated as the lines that make up a single comic drawing. Habit is the explanation.

Marks of Individuality

The acquisition of a habit may be compared with the uncomfortable process known as "breaking in" a new pair of shoes. It is painful at first, but there comes a time when the habit, like the shoes, becomes set to our conformation. Like old shoes, we wear the habit without ever being aware that we have it on.

Habits actually become so much a part of an individual that in the case of well-known men the habit often is an identifying mark, quite as much as are facial and other physical characteristics. "Uncle Joe" Cannon, late Speaker of the House of Representatives, had the habit of smoking long cigars. Through thousands of photographs and cartoons published dur-

ing his long public career, this habit was so well exploited that most people probably would have failed to recognize a likeness of him without the inevitable cigar.

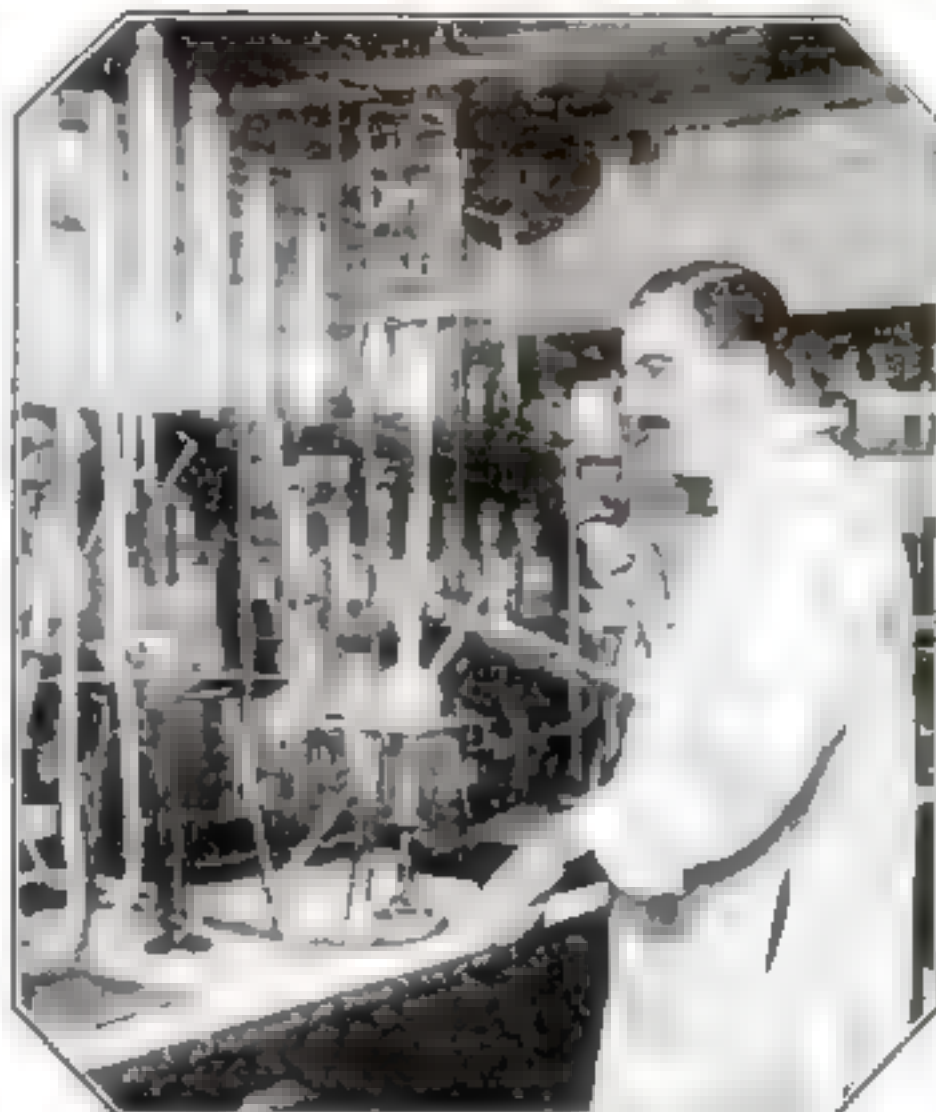
Everybody knows that the enormous amount of work Edison has accomplished is traceable largely to the habit he acquired early in life of getting along with very little sleep. When Clemenceau, the "Tiger of France," visited the United States a few years ago, the reason for his marvelous vigor at an advanced age was revealed in his regular and abstemious habits.

Woodrow Wilson His Own Typist

While Woodrow Wilson was President, his custom of writing important speeches and documents in shorthand or on his own typewriter was commented on frequently. Though he had secretarial and stenographic aid at his call, nevertheless the habit of years persisted—he thought most clearly when he himself performed the mechanical work incidental to composition.

The late Professor William James, noted psychologist of Harvard University, likened a habit to a groove in the nervous system, down which impulses flow, making the groove ever deeper so that the im-

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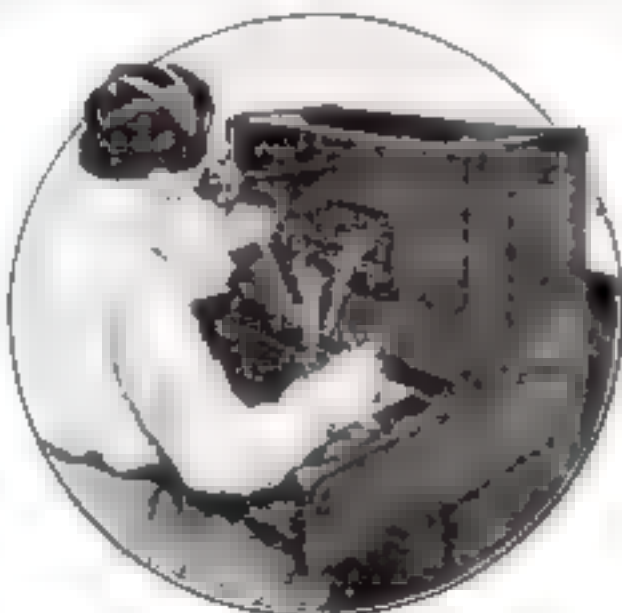


This chemist is typical of the man who finds it quite impossible to do his best work unless he has a pipe or cigar between his lips. He probably is quite unconscious of the fact that he is pulling on his pipe. His whole attention is concentrated on his experiment; yet habit causes him to perform all the actions incidental to smoking. How many times have you caught yourself pulling on a cold pipe?

And it difficult to go to sleep immediately when we go to bed. When it ends, we find ourselves for a time waking up too early in the morning and becoming drowsy at night before what, according to the clock, is our bedtime.

Change of environment likewise upsets our habitual routine. People who do little traveling are restless in hotel beds or sleeping-car berths, while experienced travelers sleep peacefully, no matter what their changed environment may be.

City dwellers are not aware that they hear the rumble of traffic and the roar of street cars—sounds that are all but agonizing to the visitor from the country. Similarly, city people are acutely aware of the noises made by insects and animals, the rustle of trees and similar sounds peculiar to the rural districts, while country people



Through habit the experienced telephone switchboard operator reaches instantly for the right plug when she hears a certain number of notes in the telephone receiver.

Mechanics, My Aid in the Wilds

By Captain Frank Hurley

World Famous Explorer, Discoverer of the Lost Tribe of New Guinea

IN THE imaginative hours of impetuous childhood, who has not been fired with the soul-stirring desire to become a carefree buccaneer?

Thus it was in my early life, even though the years were wrought in the hard school of iron, and tempered by poverty.

To gain a sound fundamental knowledge of mechanics, to be master of metal, this was to be my chosen occupation. So for five years I labored, the day at the lathe, the evening at college. Later I devoted four arduous years to the study of photography. Little did I ever imagine that the wild fancies of childhood ultimately would rise supreme and subvert my engineering plans for the future.

An Opportunity

Yet what a dominant part those years of practical application were to play in the ultimate success of the many hazardous enterprises upon which my primitive romances launched me!

The golden opportunity came while Sir Douglas Mawson was manning an Australian expedition to explore the antarctic regions, and every shoulder that carried a camera joined in competition. Though the chances were at least 1000 to one against me, I was chosen simply because I had photographic skill and a solid backing of practical mechanics.

When I turned southward to the regions of eternal ice, my chest of tools included as careful and complete a selection as my battery of lenses. The expedition's personnel was chosen from the "Don" graduates of Australian universities, highly trained in theory—men to the core—but in mechanical practice quite deficient. I shall never forget the rude yet amusing experiences of those first antarctic days when the scientists unscientifically erected our winter quarters hut.

I remember Dr. Xavier Mertz, ice expert, sitting straddlewise the ridge cap, enthusiastically banging at nail heads, but more often hitting his finger nails. Inside the house the learned bacteriologist, Dr. Archie McLean, with equal ardor, was



Science and art meet in the jungle. Captain Hurley is shown above taking photographic records of primitive native songs of the New Guinea. A theme from one of these weird chants has been elaborated into a past tune to be published soon. Note the strange musical instrument held by the savage head hunter at the extreme right.

At the left is Captain Hurley, fearless explorer, holding a bowstring that he brought back with him from his exploration in New Guinea.

He Made His Own Way

"FIND a way or make one!" is Capt. Frank Hurley's apt summing up of the secret of achievement—advice based on the experiences of his own remarkable career of adventure.

Twenty years ago a poor boy in Australia, he has made his way successively as machinist, engineer, photographer, war hero, explorer and writer. Now, at the age of 34, he finds the eyes of the whole world focused on him as a result of his discovery of a lost savage tribe in the jungles of New Guinea, territory never previously explored by a white man.

Captain Hurley was official photographer to the late Sir Ernest Shackleton's South Polar expedition. He has taken part in other polar explorations and is now planning another trip into the antarctic. He has explored Australia's unknown territory by automobile, being possibly the first man to use a motor car in prosecuting an exploration.

His own story of how his mechanical skill, acquired in boyhood, carried him safely through the most desperate situations, is an inspiring chronicle, bound to stir the blood and to stimulate the spirit of every lover of adventure.

tacking on the light ceiling boards directly underneath, using four-inch nails. A wild yell and Mertz leaped, slid precipitately down the sloping roof, clutched wildly at the stay supporting the kitchen chimney, and dove headlong into a snow bank carrying the smoking stack with him. Closer investigation of the cause disclosed an inch of piercing nail bristling through the roof from whence the punctured Mertz had so hurriedly risen.

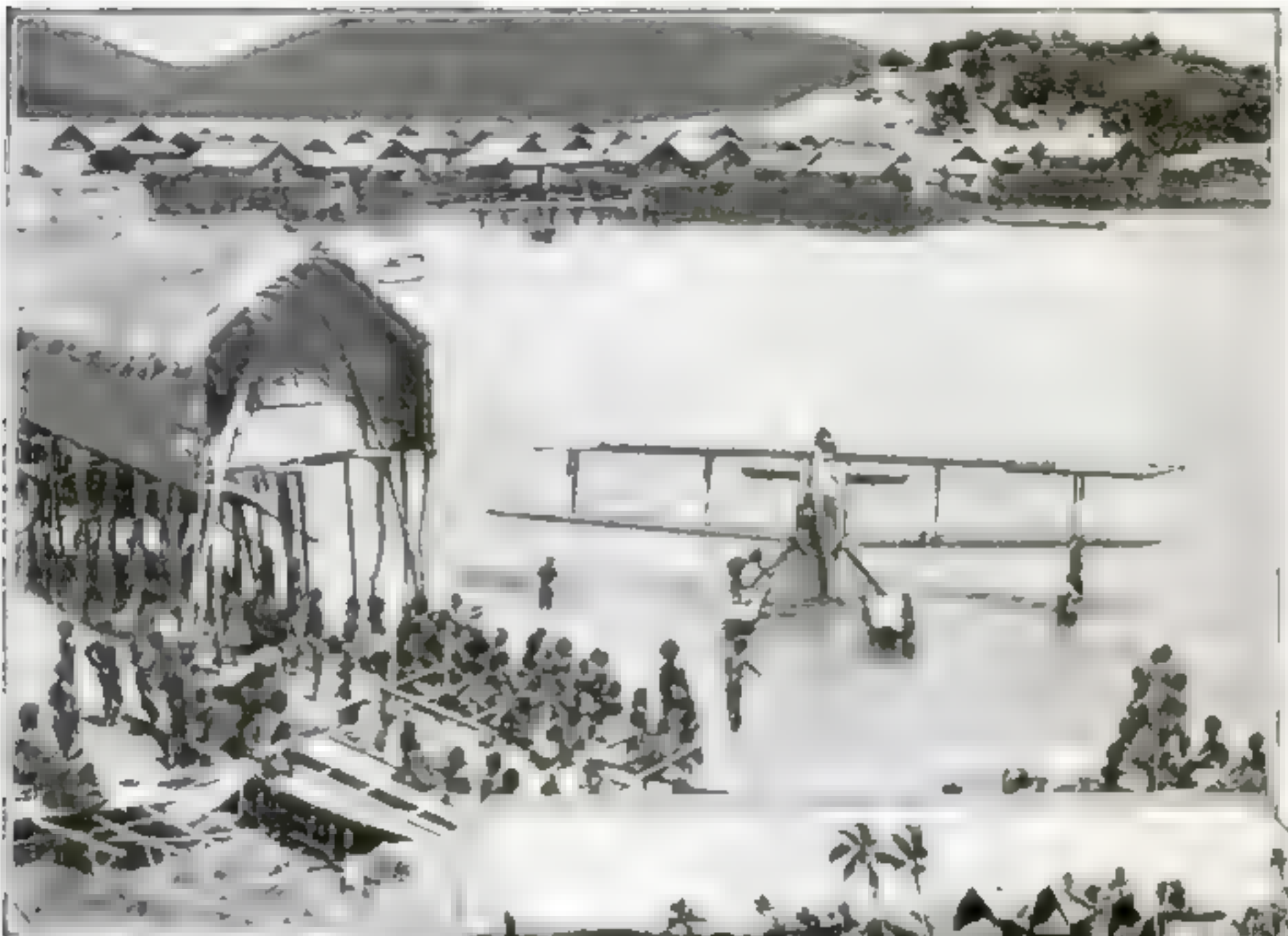
Antarctic Inventions

Cut off from the world for more than a year, we were thrown entirely on our own devices and resources. The frigid conditions necessitated alterations in my cameras and the making of special developing appliances with warm-water circulators. In addition, various scientific instruments and wireless equipment demanded ceaseless attention, so the mechanic became a very important man. I even added to the expedition's store of scientific apparatus by fashioning from odds and ends various instruments for meteorological observation.

One of these I called the "blizzard detector." It consisted of a metal ball mounted on a mast above our hut, insulated from the ground and connected with a simple gold leaf electroscope inside the hut. Atmospheric electricity generated by a snowfall was taken up by the ball and traveled to the electroscope, which was connected through a relay with an electric bell circuit. When the electroscope was charged, its movement closed the circuit that operated the bell, and the snow alarm rang out. This contrivance proved most efficient, so much so that one of the party, after being awakened by it a half-dozen times one snowy night, hurled a boot at it and finished it.

Alarm Clock Wind Detector

I also made a machine for detecting the velocity of the wind, which averaged 49.9 miles an hour during our stay, reaching at one time a velocity of 214 miles. An alarm clock served as the basis of this instrument. The hour hand of the clock caused a dial of smoked paper to describe a complete revolution once a day. Against this dial was placed a pointer, balanced by a spring and connected



The residents two aeroplanes, landing with perfect white man, but a signal machines ever had been seen, filled the New Zealand. After much persuasion they were induced to approach the planes.

with a circular dial, hung on a long horizontal wire. As the wind moved this the movement was transmitted along the wire to the pointers, which scratched the marked surface of the dial. Photographs of the curves scratched on the dial supplied us with accurate wind records.

More for amusement than anything else, I constructed a sled driven by a wind motor. A wind wheel mounted on a turret turned through a system of worn gears, two spiked wheels in the runners. As the spikes sank in the snow, the sled moved forward. By setting the fan according to the direction of the wind, it was possible to steer the sled to travel with the wind, against it, or at an angle to its force.

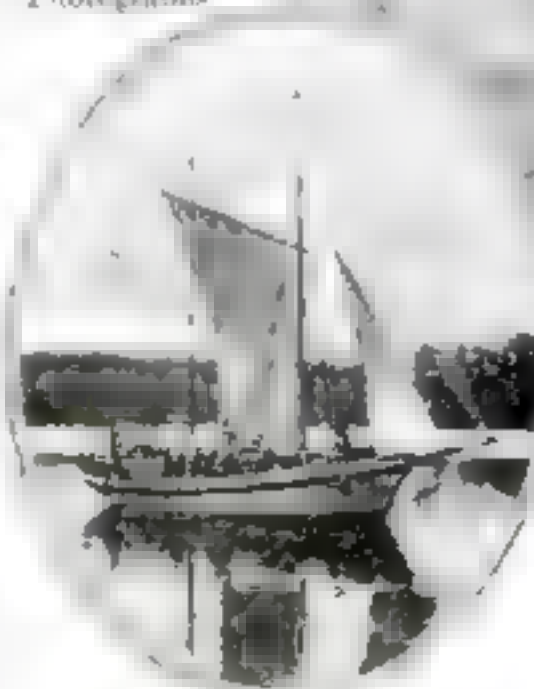
The manufacture of these devices gave me my first experience in utilizing scraps for the fashioning of useful articles, an experience that proved invaluable on later expeditions, for it literally saved my own life and the lives of others and carried my companions and me safely through several dangerous emergencies.

The Mawson expedition paved the way

to others—the East India, a second antarctic cruise and finally a small venture of my own, when I joined forces with Francis Birtles, another Australian explorer. In two "flivvers" we left Sydney on a 10,000-mile "joy ride" through Australia's unknown, venturing on wheels among the primitive aborigines. Had it

not been for our mechanical initiative—Birtles had also served his time in iron—the journey never could have been accomplished. Little other than the essential working parts of the "flivvers" remained upon our return, and these displayed many crude thermite weldings, and

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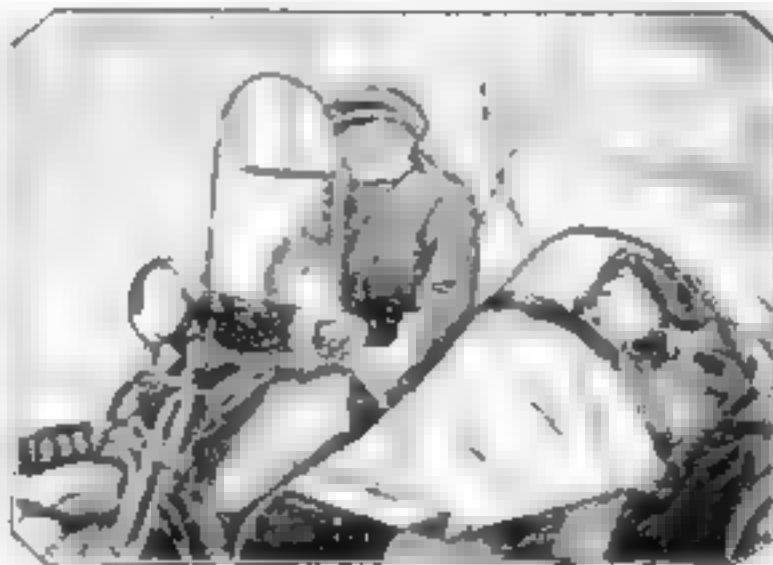
The natives believed the white men were gods and, being so well armed, would attack them unless appeased. Each night, as the flying boat's lat of anchor, the natives brought a pig to satisfy the appetites of the terrifying visitors from the skies. One of the pigs is shown above, being carried to the boat of the natives. The explorers were careful to remove the pig before morning, so that the natives would believe the wanted monster had devoured it. At the left, the light shafts were used by Captain Hurst as a signaling tender. A radio equipment carried in a plane, a few days before over the jungle and made possible speedy location of the machines.

New Motorcycle Comforts

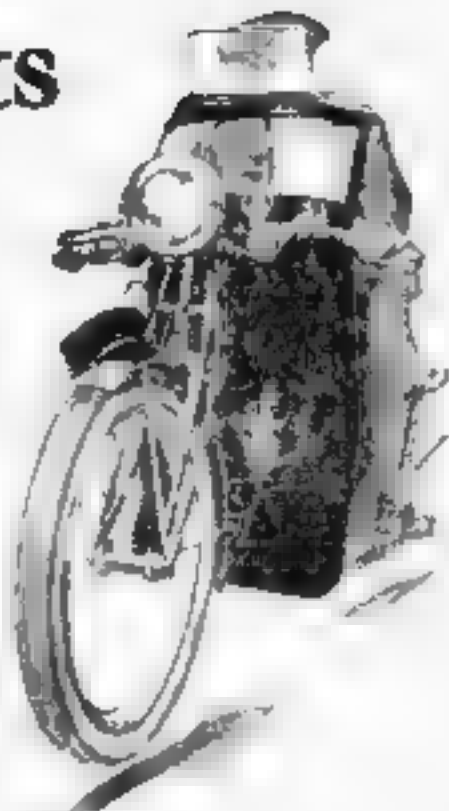
All-Weather Shields Protect Riders Snugly



Face and body shields for the driver, side curtains and top for the sidcar give protection to the riders in stormy weather.



Rain wind or sun can be kept off a motorcyclist by a suit of armor that is made of materials that are fast for riding, very strong and yet are also a comfortable material.



The apron, attached to the frame is surmounted by a celluloid window and face shield.

By Newton Burke

RECENT developments in the design of motorcycles indicate that the problem of protecting riders from the wind, rain, and snow of winter—a problem that has engaged the attention of designers since the use of the machines became general—is about to be solved.

The sidcar already has been made snug and weather-proof. Now the comfort of the man in the saddle is being provided for.

American engineers are watching with interest a new development that is expected to do much toward making the motorcycle an all-weather conveyance. This is a design by French engineers that would inclose the rider in a cab, providing freedom of movement and clearness of vision without the usual exposure to the weather.

Light Frame Holds Hinged Top

A light metal frame, streamlined, would be attached to the frame of the motorcycle in such fashion that the handlebars and front wheel could be turned at any angle within the body. A large celluloid window would give the driver clear vision, at the same time extending far enough above his head to deflect all wind and rain beating from the front.

Should rain come at such an angle that it would strike him in the back, he could unfold a hinged top that would fasten to the frame and cover him, thus inclosing him in a cab. The sides then would be left partly open to allow arm signals. Wide, curved leg shields would protect the rider from beneath, and side plates would cover the engine. A slight extension of the exhaust would permit gases to pass out from the inclosure.



One of the first face guards—an apron belted about the driver's waist—supplemented by a celluloid window extending to the top of his head.

The present-day French design is suggested by American engineers.

"There is absolutely no reason why such a shield cannot be designed," said one motorcycle authority. "If the French engineers have succeeded in overcoming the difficulties that others have experienced, they will have demonstrated an improvement that should find considerable use, especially in Europe, where the motorcycle finds wider application than in America. Any practical device that will add to the comfort of a motorcycle rider will be welcomed where motorcycles are used for service as well as for sport."

While the design of the French engineers is radical in that it proposes to inclose the whole body of the rider, it follows along the recent advances made by American engineers in developing protective devices. The first of these was a top and side shield that converted the sidcar into a closed cab. Next, designers undertook to protect the driver from rain and mud by shoe and leg guards, some types of which covered the legs entirely. But this left the face without protection.

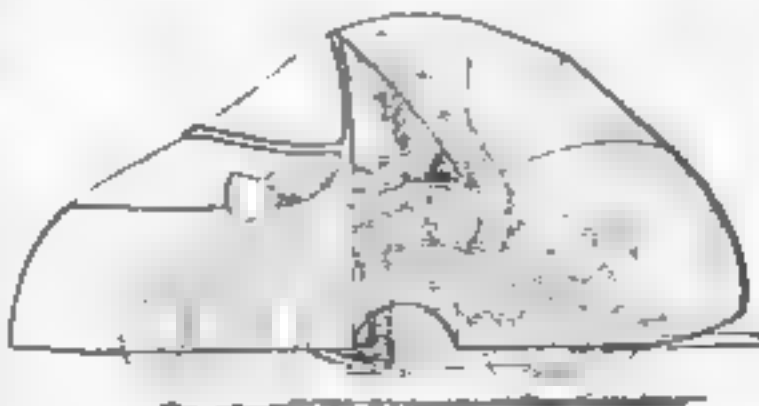
One early and effective face guard was an apron belted about the waist of the driver and with a celluloid shield extending upward to the top of the driver's

head. It was held at a comfortable distance from the face by arms extending from shoulder straps. The apron curved slightly, to reduce wind resistance, and served to keep water from running down on the cyclist's trousers.

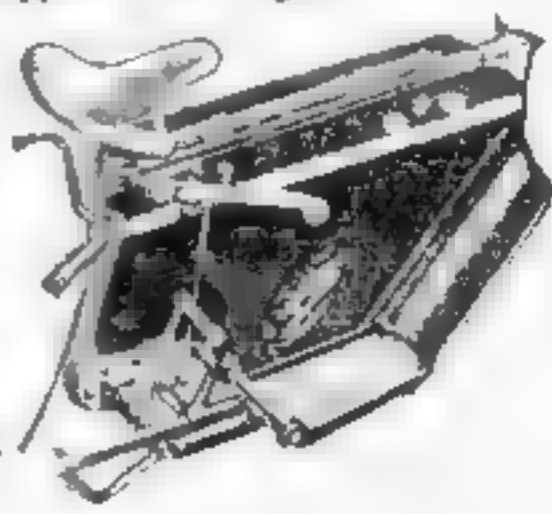
Another shield fastens to the frame of the machine. An apron extends downward from the handlebars to a point below the level of the wheel hub, protecting the legs from splashed mud and water. The upper portion above the handlebars has a curved window of celluloid. Above this is mounted a movable window to which may be fastened an automobile windshield wiper. Since this shield is curved and tilted slightly back toward the cyclist, the wind resistance is practically negligible. The protective device is attached to the frame in such a way as to avoid any interference with the control and operation of the machine.

Motorcycle Development Is Rapid

The transformation of the motorcycle from a motorized bicycle to the highly efficient vehicle has been rapid, from a mechanical viewpoint; but in the matter of comfort for the driver and passenger the advance has not been so marked. However, with engineers here and abroad working on the problem, the transformation of the breezy, two-wheeled speedster into a comfortable, all-weather conveyance appears to be in sight.



The new French design for converting the motorcycle into a cab. A streamlined metal frame supports a hinged hood that can be lowered about the rider.



Leg guards and a protective shield for the motor are improvements in weatherproofing.

Are You a Physical Spendthrift?

Science Explains the Tired Business Man; Overtaxed Bodies Go Bankrupt

By Reynold A. Spaeth, Ph.D.

Associate Professor of Physiology,
School of Hygiene and Public Health,
Johns Hopkins University

SOME people seem to be born tired. Yet we must assume that the average adult starts to work in a normal, rested condition. He begins his career with a sort of capital, a physiological capital, which he can spend recklessly or carefully just as if it were capital in the form of money.


When a man works, he draws on his physiological capital; when he rests and eats, his account is balanced, his energy is restored. Normally, we go through life alternately spending and saving. The harder we work the more physiological capital we spend and the more we have to rest to balance our physiological account. The man who overworks continuously with little rest is a spendthrift. Sooner or later he becomes physiologically bankrupt.

Now the fatigue produced by any specific job, say lifting five-pound packages from the floor to a shelf, depends not only on the weight to be raised, but also on the rate at which the work is done. If I lift two five-pound packages a minute, I can stay on the job almost indefinitely; but if I have to lift 20 packages a minute, I peter out in a relatively short time.

Ration Out Rest and Work

At two packages a minute I am constantly returning to my original level of physiological capital; at 20 a minute I cannot rest enough between packages to hold the pace. In other words, for any unit of work there is a corresponding time-unit of rest that will exactly and completely restore the muscles to their original working level. It is failure to regulate work to this proper speed that causes undue fatigue.

An expert bricklayer who has found his stride can lay a given amount of bricks each day without being fatigued in the evening. But let him try to hurry the job and what happens? For the first few hours he may do much more work than usual, but along in the afternoon he begins to get tired and his work slows up. By evening he has become so much slower that the net result of his day's work probably will be that he has accomplished less and is more tired than on ordinary days. His work-rest relation has been upset and his working capacity impaired.



Conquering exhaustion by the deep-seated urge for self preservation, Alan J. Gerbault, French sportsman, recently crossed the Atlantic Ocean alone in a 30-foot sailboat completing the voyage in 142 days. He is shown above in his

boat at the end of his record-making trip. His achievement is a striking example of how all of us under the stress of necessity can tap unsuspected resources of energy to perform surprising feats. For him collapse meant death.

The heart is probably the best illustration of this work-rest relation. Between beats the heart rests just enough to prepare for the beat that is to follow and to overcome the fatigue of the previous beat. Through centuries of trial and error, the heart finally has settled to a rate of work that keeps it going for from 70 to 100 years. It never gets bored with its work.

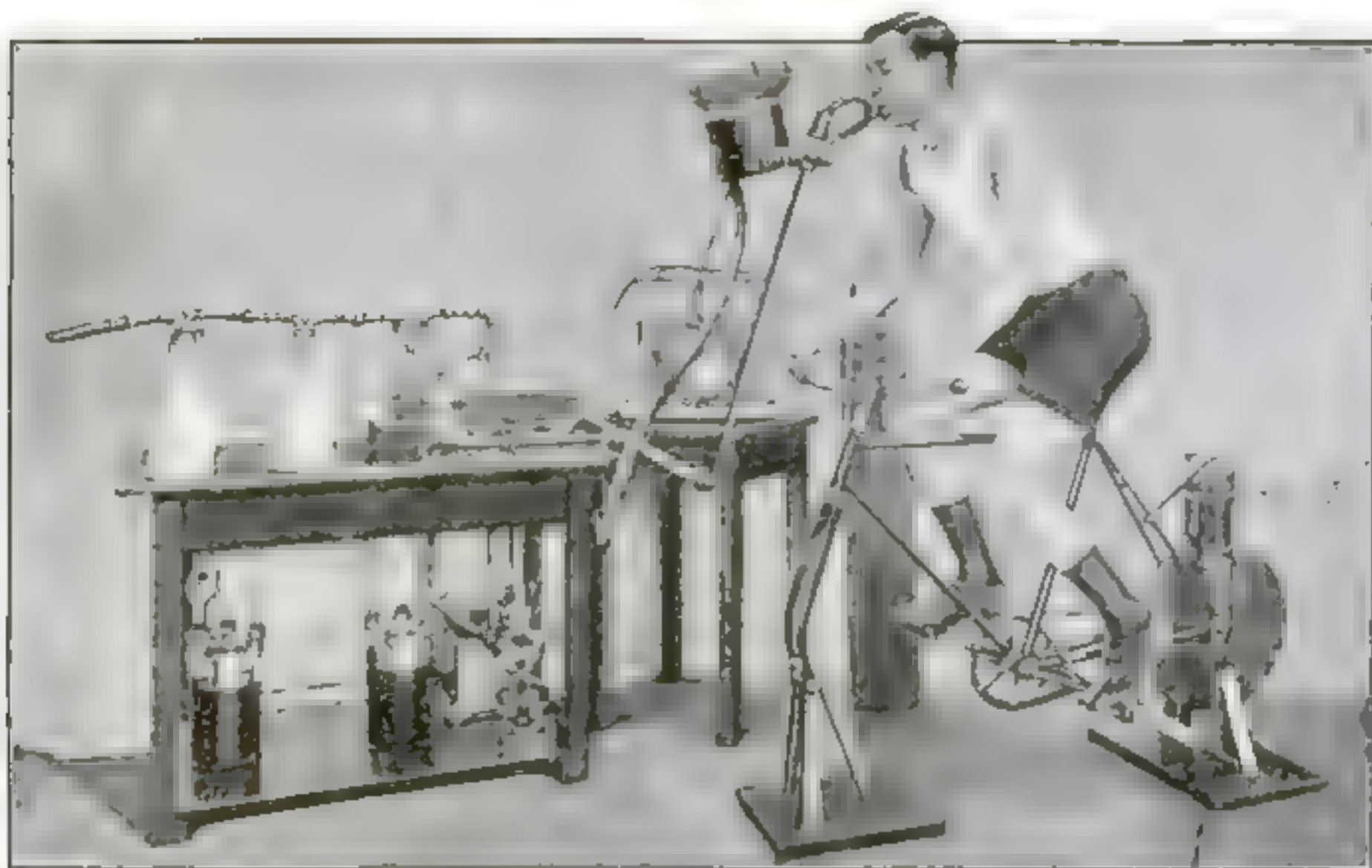
The entire human being, in contrast to the heart, is anything but a machine. Man is a willing or an unwilling, a hating, desiring, pleasure-seeking animal. We cannot set him going like a machine, knowing that he will still be running when we return. We must urge him artificially, by various incentives, to stick to his job.

In heavy manual labor, rest periods are particularly effective in protecting men against undue fatigue. But even in work that is merely monotonous or exacting, rest periods may do wonders. In an experiment that I carried out on a group of skirt pramers, two rest periods of five minutes each at 10 a.m. and 3 p.m. gave an average increase in production of more than 20 per cent. No physiological theory of calory consumption could account for such an astounding increase in efficiency. The effect was obviously psychological.

We might suppose that a man's working capacity is a stationary thing; that under any and all circumstances he is able to do the same amount of work, provided only that he has enough rest. This certainly is not true. We all know that under the stress of emotional stimulation we may perform really astonishing physical feats. The man who is chased by a bull and scales a fence at the other end of the field probably could not repeat his performance without the bull's help. After assassinating Lincoln, Booth broke his leg, but he was able, none the less, to drag himself to his horse and escape. Excitement and the deep-seated urge for self-preservation made available sources of



The ergograph—an apparatus used by Doctor Spaeth in his laboratory at Johns Hopkins University to measure the amount of work performed by students and to test their fatigue. The work consists of lifting an eight-pound weight with one finger at stated intervals, with prearranged rest periods.



This strange apparatus is employed at the Carnegie laboratory in Boston, Mass. in experiments to measure the physical energy expended in performing any specified amount of work. Here the work consists of pedaling a friction wheel of a specified load. As he pedals, the rider exhales through his mouth into a tube that carries his breath to experimental test tubes and retorts. Meanwhile his

nostrils are closed tightly by pincers to prevent escape of his breath into the air. The amount of carbon dioxide he exhales determines the amount of energy he consumes in the work. Since the work and the exhalations both are measured accurately the relation of one to the other is a measurement of the rider's physical fatigue. It determines the amount of work required to exhaust this bodily energy

energy that ordinarily he could never have tapped.

Alain J. Gerbault, a French sportsman, who recently crossed the Atlantic Ocean alone in a 30-foot boat, making the trip in 142 days, rather remarkably demonstrated this. At times, according to his own story, he was almost exhausted by lack of food and sleep, but to collapse would have meant death. Therefore, under the force of necessity, he tapped sources of energy he had never used upon before and managed to pull through. On his arrival in the United States he spent 18 hours in bed and then apparently was as fresh as ever.

Consider how you yourself respond to music. If the orchestra is good and especially if you enjoy the rhythm of the tune, you will dance far into the morning without unpleasant consequences. If you had to spend the same amount of energy removing ashes from the furnace or darning socks, the job would seem interminable. Work measured by ordinary performance gives us no idea whatever of what we might accomplish if only the incentive were strong enough.

The Human Engine

It has long been known that the energy consumed in muscular work is derived mainly from carbohydrates (starches and sugar), stored in the form of glycogen in the liver. Normally this fuel, in the form of sugar, is released into the blood in small

amounts, carried to the muscles and there burned up much in the manner of an automatic furnace.

Professor W. B. Cannon, of Harvard University, and his students found that under the stress of excitement or emotion there is set free in the blood a secretion from a pair of small glands near the kidneys (the adrenal bodies) which speeds up the sugar-releasing machinery of the liver and enables all of us, under stress, to accomplish surprising feats.

Excitement, fear, pain, or rage, all set the sugar machinery going. If the emotional disturbance is a false alarm, calling for no muscular activity, the excess sugar is excreted in the urine and the normal sugar balance is restored. Doctor Cannon

once tested the urine of a number of substitutes who sat on the side lines at a Harvard-Yale game. Five of these men showed sugar. Merely watching the game and anticipating taking part in it was enough to set the physiological preparedness machinery in motion. An excited spectator who was examined also gave a positive sugar test.

Excitement does more than affect merely the sugar supply to the muscles. Through the stimulation of the sympathetic portion of the involuntary nervous system, the pulse is quickened, the blood pressure rises, and there is a redistribution of blood from the stomach and intestines to the arms and legs, where the muscular work of fleeing or fighting is concentrated. Thus all the physiological changes that accompany excitement are preparation for sudden and intense action.

The value of such changes to an animal in its struggle for existence are obvious. The value to human beings becomes evident when we consider that even for civilized man emergencies arise that can be met only by terrific bursts of physical energy.

The Mental Factor

Another and very subtle factor markedly affects our working capacity. I refer to our mental attitude toward the job. A simple laboratory experiment will make this point clear. In my laboratory I have an apparatus with which I can measure the

You Can't Cheat Fatigue

YOU can't borrow from yourself without paying back if you would maintain your solvency. This is true of your physical capital as well as of your financial reserve, as any physiological credit man would tell you.

In this article Doctor Spaeth tells how the physiological spendthrift brings himself to bodily bankruptcy by borrowing on his reserve without making replacements, and how fatigue finally collects its debt.

Doctor Spaeth is dealing with facts, not theories. The facts were determined by careful experiment and they have a vital bearing on your every-day life. Read what he has to say and then check up your own bodily capital. It may save you from physical bankruptcy.

(Continued on page 155)

Maude Adams as an Inventor

Beloved "Chanticleer" of the Stage Perfects Radical New Process of Daylight Movies

By Truman Stevens

WHILE sweeping improvements have been made in motion pictures since the days when they were merely a scientific curiosity, in one or two vital particulars the movies until now have remained unchanged. One of these has been the necessity of exhibiting them in a darkened theater. Another has been the failure of the usual black and white tones of the images projected on the screen to create more than an imperfect illusion of the living quality in the scenes depicted.

Recently, though, came an announcement of tremendous interest to all motion-picture patrons. A process, it was said, had been perfected to show moving pictures not only in broad daylight, but in full natural color. The color effects were to be produced not through artificial tinting, staining of the film, nor by means of color filters, but by a direct method of color photography.

Actress Becomes Inventive Genius

The most amazing phase of this announcement, perhaps, is the fact that the new daylight color movie process has been developed by a person who never had been associated in the public mind with any sort of scientific or inventive work. The inventor is Maude Adams, who, when she retired from the stage five years ago, was America's best loved actress, famous for her "Peter Pan," for her "Chanticleer," and for a long list of other parts that had made her the idol of theater goers.

Miss Adams conducted her researches and experiments in special laboratories

provided for her at the plants of the General Electric Company in Schenectady, N. Y., and of the Eastman Kodak Company in Rochester, N. Y. The details of the process she is said to have perfected are being kept secret.

The announcement regarding her method of projecting pictures in daylight is limited to the statement that it depends on a non-actinic light that she has developed; that is, a light lacking the chemically active properties of ordinary sunlight or ordinary artificial light. That her inventions have been brought to a practical stage of development, though, is indicated by the fact that a photo play, in which the new processes will be used already is in the making.

Colored moving pictures have been produced by various processes and with varying success since the early days of the industry. One method, dating back a score of years and still in use, consists of

applying paints or tints to the film by hand, a long and tedious process. In other processes ingenious use has been made of the principle on which color-plate printing depends—namely, that by blending two or more of the primary colors an illusion of natural color may be obtained.

One method popular several years ago depended for its success on the rapid revolution of alternate filters of red and green in front of the film in projection. The blending of these colors in the projected images created an impression of colored photography.

About a year ago Dr. Daniel Frost Comstock, of Boston, Mass., perfected another ingenious color process. In this only red-orange and blue-green rays were permitted to reach the film. The individual exposures were alternate blue-green and red-orange impressions, though the film showed only black and white. In printing, the images were superimposed. Then the film was dyed, the blue-green images taking blue-green dye and the red-orange images, red-orange dye. When the film was projected, the eye saw the pictures apparently in their natural shades.

Devotes Her Life to Science

It is said that Miss Adams' method not only is revolutionary, but is entirely original in conception. It is, in fact, the result of years of study and research.

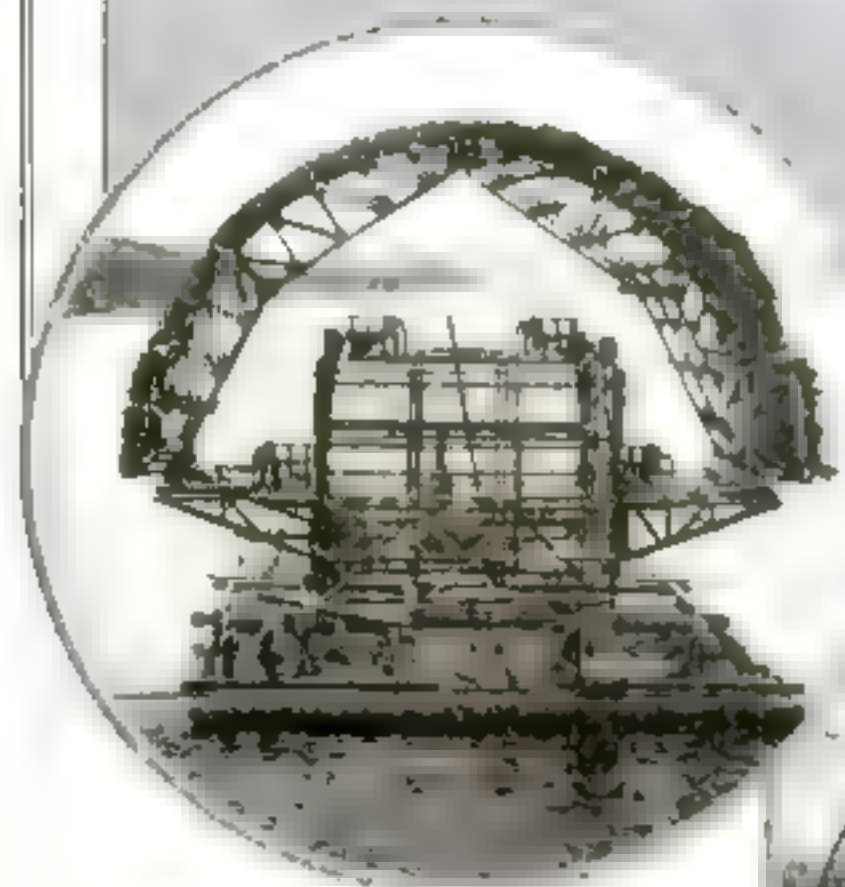
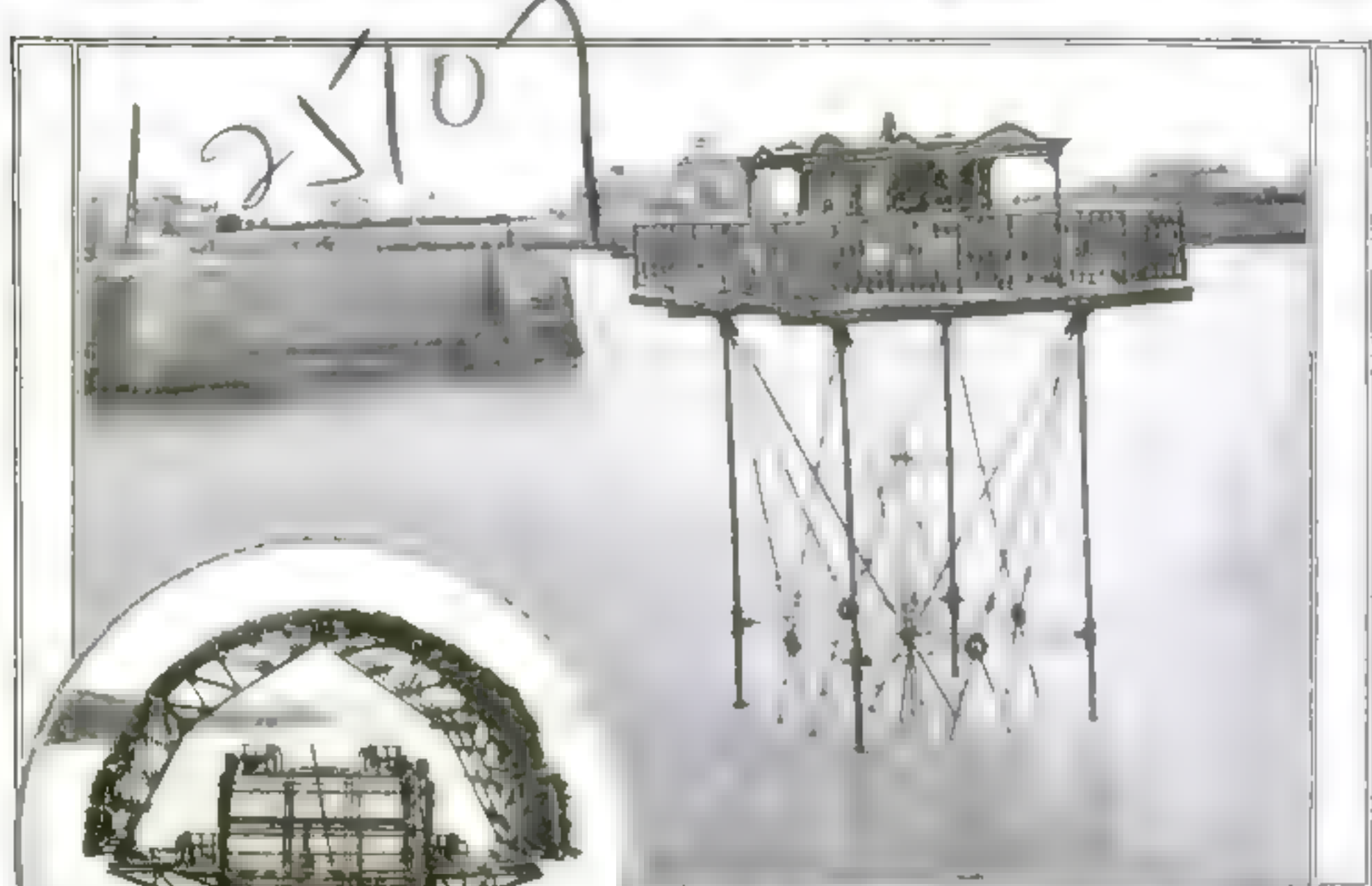
While Miss Adams was on the stage, it is said, her chief interest, aside from her art, lay in the technical details of stage lighting. To her, the electrician of her company always was a most important member of the organization, and she spent every available moment discussing with him the various phases of theater illumination and devising new lighting effects. And during all this time she was keeping pace with the new developments in the science of lighting.

For the last five years she has literally lived in the laboratories prepared for her at Schenectady and at Rochester. Not even Edison, when he was developing the incandescent light, labored more ceaselessly than she in bringing about this new development in illumination. Her retirement was as complete as if she had entered a convent. Indeed, until the recent announcement of her work, many of her admirers assumed that it was to a convent she had gone. It was not to religion however, but to science that she had decided to devote her life.

Maude Adams as "Chanticleer"

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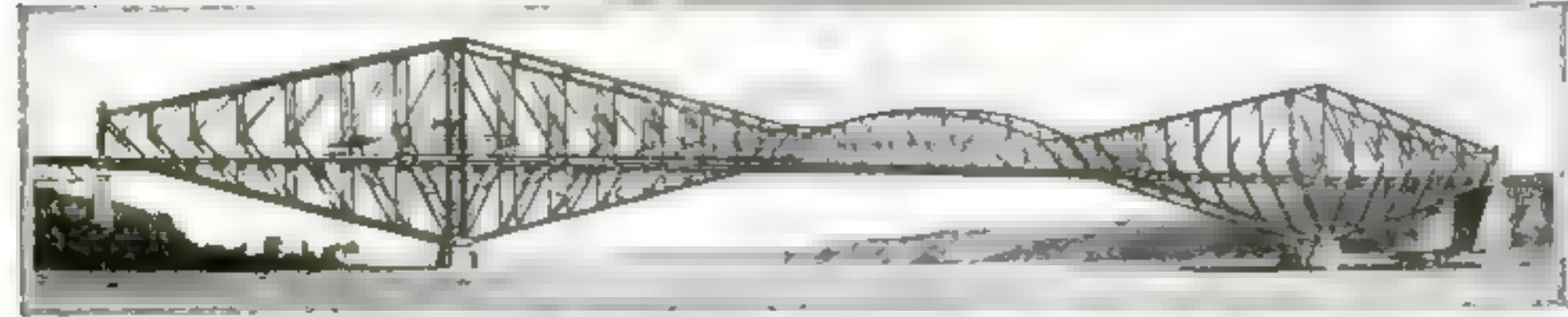
World Wonders in Bridge Building



Below the bridge is a large river. The bridge is a cantilever bridge, and the number '12510' is written above it.

Engineers who built the new Phoenix & Reading River bridge, which spans the San quahanna River at Haverhill, Pa., saved thousands of dollars and several weeks of labor by the ingenious experiment of floating the entire structure down the river, and then its position.

At the right is shown the old spiral bridge spanning the Mississippi River at Hannibal, Mo. Since the height of the bridge necessitated an extremely long approach, this approach was built on a spiral to give access to the river waterfront.



One of the world's greatest engineering achievements is the huge cantilever bridge that spans the St. Lawrence 10 miles up the river from old Quebec. The length of the span, the longest ever built, is 1900 feet, distance between piers 1800 feet.



An early view of the bridge at Saint Pierre de Vauvray showing the construction of the arch.



This magnificent reinforced concrete bridge across the Seine at Saint Pierre de Vauvray, France, is said to be the greatest structure of its kind. It was completed a few weeks ago by President M. Merand. Insets show the bridge during construction and complete.

The large structure above shows the huge concrete arch during construction. It is 403 feet long and 114 feet high. Note the steel supporting structure which later was removed by unusual engineering methods, the arch supporting its own weight as well as that of the span.

New Mercury Boiler to Save Fuel

Revolutionary Power System Offers the Possibility of Cheaper Electricity for Our Homes and Factories

By Donald Harris

A NEW era of cheaper electric power and light for homes and factories is foreseen by engineers in the announcement of the successful development of a revolutionary mercury boiler which, in generating metal vapor instead of steam, promises to make one ton of coal do the work of two and to effect a tremendous saving in the world's fuel supply.

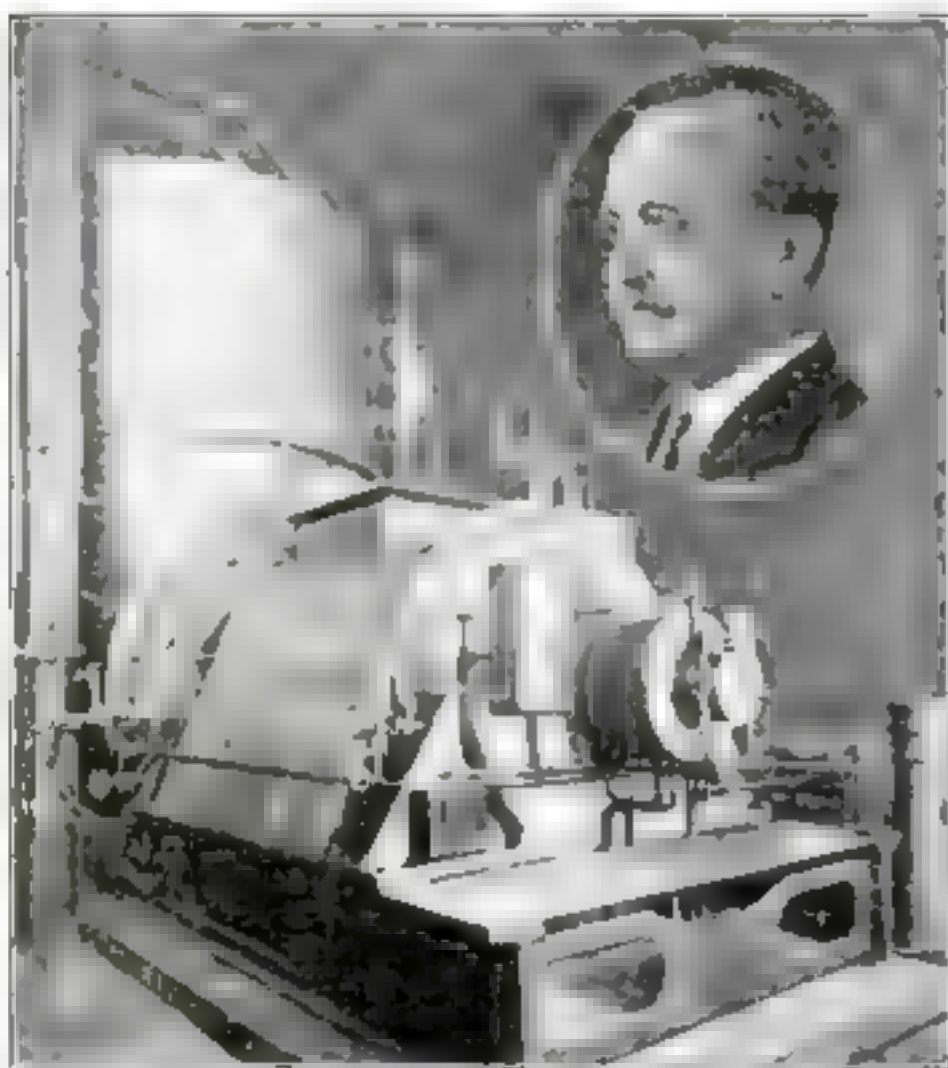
Successful Tests

The boiler is the invention of William LeRoy Emmet, consulting engineer of the General Electric Company. While it has not reached a stage of development where it can be applied generally for commercial purposes, yet in actual tests at the plant of the Hartford Electric Light Company at Hartford, Conn., it is reported to have developed 50 per cent more electric power than that produced by a steam generating plant using the same amount of fuel.

As the result of these tests, the advantages of the new power unit, in addition to the tremendous saving in fuel, are announced by the inventor as follows:

Its installation in a power house requires no radical changes in apparatus other than the substitution of a mercury boiler for the steam boiler.

The mercury is used over and over



Installation of the new mercury vapor power unit at one of the plants of the Hartford Electric Light Company, Hartford, Conn., showing the generator in the foreground and the cylindrical mercury vapor condenser at the rear. William LeRoy Emmet (insert) is the inventor of the boiler.

The secret of the increased power efficiency lies in the fact that the heat generated for a single power plant is utilized to drive two power plants instead of one.

Reports of the remarkable performances of the invention in the Hartford plant indicate what we may expect of it eventually in the saving of fuel and consequent reduction in the cost of electric power to consumers.

Predict Huge Saving

In Hartford, with a population of 175,000, the Hartford Electric Light Company spent about \$1,500,000 in 1922 for fuel to generate electricity for homes and factories. Using the mercury power system, officials of the company announce that they expect to save \$750,000 a year on fuel with the present installation, or \$250,000 more than the cost of installing the system.

Officials of both the General Electric and the Hartford companies say that the chief saving to the public will come indirectly through the lessening of demand for fuel

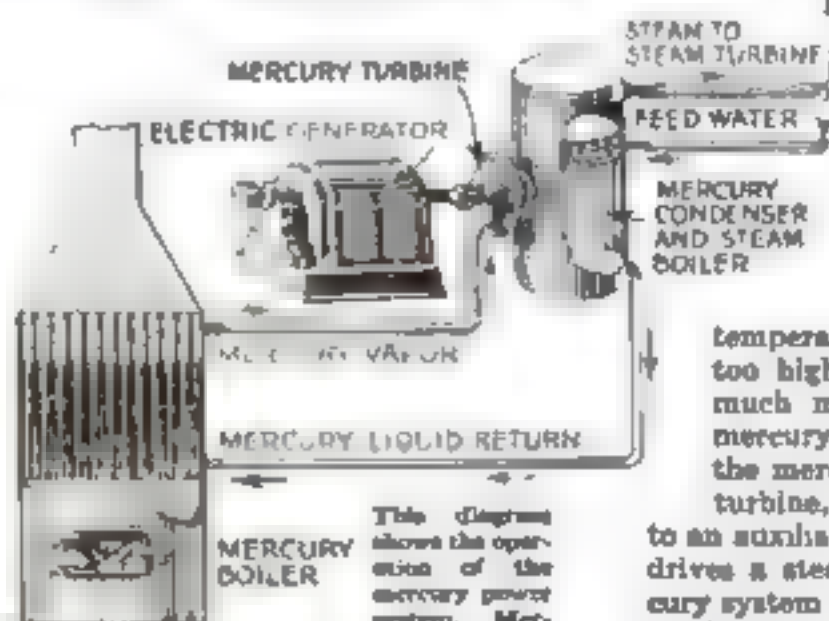
and the extension of uses for electricity, rather than through any immediate reduction of electric rates.

The idea of the mercury boiler is based on the fact that mercury boils at a much higher

temperature than water, though not too high for ordinary fuels. Thus, much more heat can be stored in mercury vapor than in steam. As the mercury is vaporized to drive a turbine, this excess heat is passed on to an auxiliary steam plant which in turn drives a steam turbine. Thus the mercury system literally "kills two birds with one" stone. It runs two power plants instead of one.

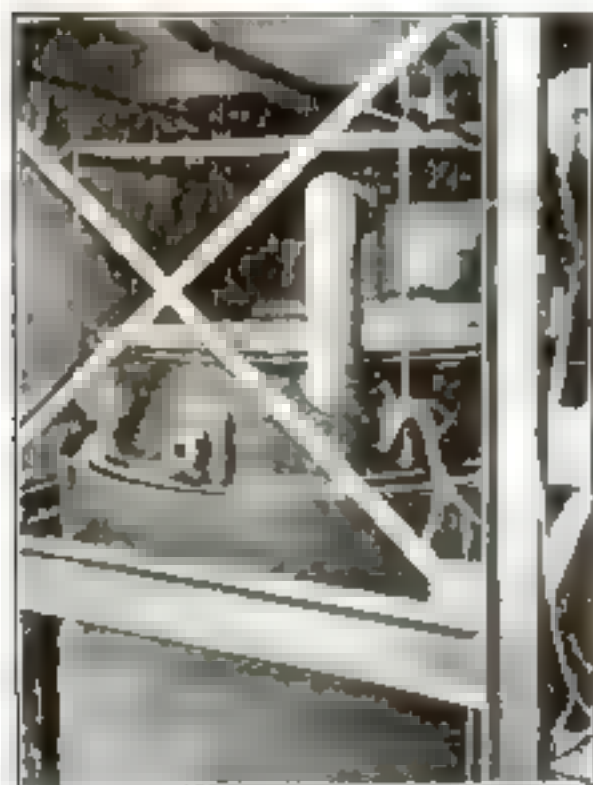
In the Hartford plant the mercury boiler occupies the space required for a 600-horsepower water boiler, yet it develops 9300 horsepower. It uses 30,000 pounds of mercury; yet experiments since its installation promise that slight changes in design will cut this quantity in half.

Mr. Emmet's apparent success in producing a revolutionary power-producing apparatus crowns a career rich in scientific achievement. The inventor is an Edison medal winner, conductor of notable research in the uses of alternating current, the developer of the Curtis turbine, and the father of electrical marine propulsion.



This diagram shows the operation of the mercury power system. Mercury heated in the boiler passes off as vapor. This is carried through a pipe to drive a turbine which runs an electric generator. Exhaust mercury vapor then passes from the turbine to the condenser, into which water is fed. Heat of the mercury vapor exhaust is sufficient to boil this water, and the resulting steam passes through a pipe to drive a steam turbine. The mercury now condensed to a liquid, returns by gravity through a pipe to the mercury boiler, completing its cycle.

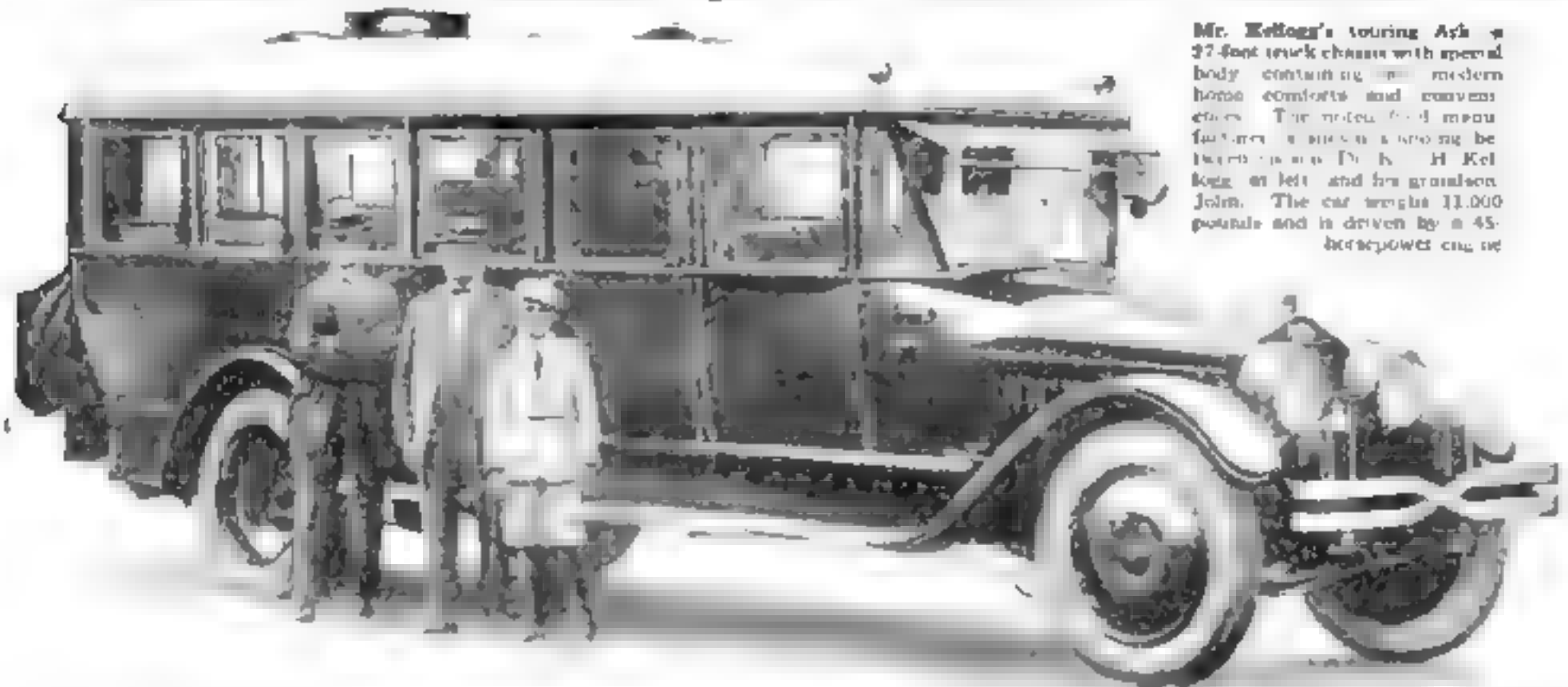
again in the vaporizing system without appreciable loss and without the necessity of replenishment. Since all joints are welded to prevent escape of mercury vapor, there is no danger to workmen from mercurial poisoning.



The mercury boiler suspended above the furnace. Vaporized mercury drives a turbine, then gives heat to generate steam.

"No Place like a Home on Wheels"

A Modern Noah's Account of His Travels in a Motorized Ark



Mr. Kellogg's touring Ark is a 27-foot truck chassis with special body containing all modern home comforts and conveniences. The motor and menu features a motor and menu being taken up by Dr. H. H. Kellogg on left and his grandson, John. The car weighs 11,000 pounds and is driven by a 45-horsepower engine.

By W. K. Kellogg

LIKE Noah, I have built an ark.

Not that I am anticipating another deluge. On the contrary, my ark, though capable of withstanding severe storms, is strictly a land craft. Also, it was not designed to supply a necessity. It was built for amusement—so that I might give full expression to my only hobby, which is motor touring.

My Ark is a 27-foot automobile—a truck chassis on which I have mounted a special body containing all the comforts any one might desire by day or night on an extended tour.

It is equipped with beds, tables, easy chairs, a kitchen, a bathroom, a heater, a refrigerating plant, even a radio set. It carries camping equipment, including a 15-foot folding motorboat.

It can travel at from 30 to 35 miles an hour over comparatively rough roads without discomfort to the passengers and without interrupting enjoyment of radio broadcasting programs as they are reproduced by the loud-speaker hanging over the chauffeur's seat.

The concern that built the Ark for me calls it a "special Pullman tourist coach." But it is more than that. It is a real home on wheels, permitting me to go where I please for as long a time as I please without worrying about hotel accommodations, railroad connections, or any of the other vexations of the ordinary "trip."

In the Ark is incor-

EVERY motorist or prospective automobile owner who has felt the lure of the open road will find enjoyment and profit in this unusual article by W. K. Kellogg, noted food manufacturer of Battle Creek, Mich.

Here he tells how he found the secrets of health and happiness in the untraveled places—how he conceived and built his motorized ark, a cozy traveling dwelling on wheels equipped with every appointment of the modern home, even a radio set.

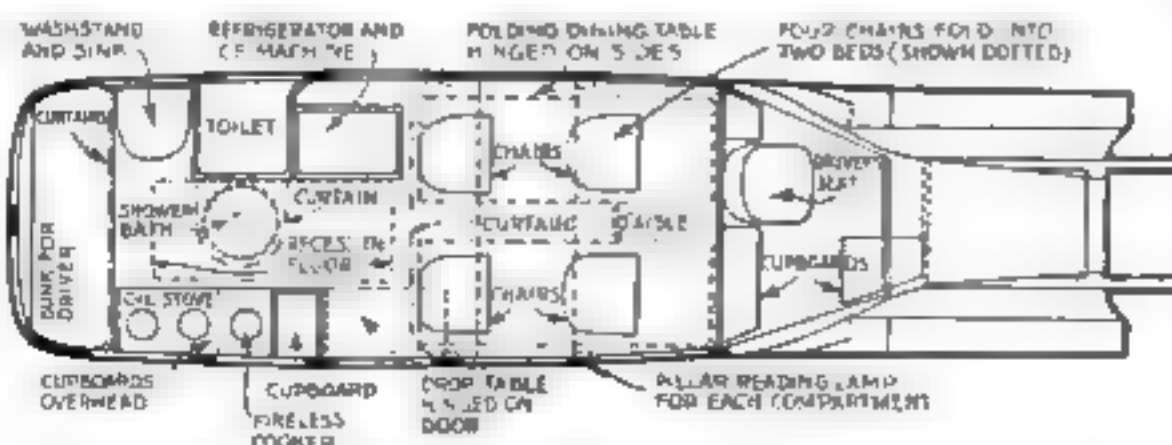
Of course, not every man can own such an ark, yet who is there who cannot find the same happiness as Mr. Kellogg's in the pursuit of a congenial hobby, or reap the same benefits in health by meeting Nature on intimate terms in out-of-the-way places?

porated the results of what I have learned in 15 years of motor touring, as well as suggestions I obtained by collecting all available data regarding the experiences of other tourists and automobile campers. It is unique, but it is in no sense a freakish

vehicle. It is entirely practical and useful. In building it I made no attempt to attain luxury or unnecessary elaboration. What I wanted was the essentials of a well-ordered home in order that in touring I might become independent of the territory through which I might travel. Thus far it has performed wholly up to expectations. Mrs. Kellogg and I now are well along on the first lap of a tour which, within the next year or 18 months, will take us to the capital of every state in the Union. This winter we are touring the South. In the spring we shall go north, then cross the continent up and down until we have completed our itinerary. Practically our entire time will be spent in the Ark. We shall travel in it, eat our meals in it, sleep in it, except for such times as we may find ourselves near good camping and fishing grounds, when we shall get out our camping gear and approach closer to Nature than even the Ark permits us to do.

This is my idea of real motoring, of getting full use out of a car. People who motor on the beaten tracks—through city parks, over well-paved roads that skirt inhabited places—miss many of the thrills that come from pursuing this healthful, invigorating sport through the open country. Playing the vagabond in a motor car is the most fascinating pastime I know of, and, in my opinion, it is the most satisfying, helpful hobby a man could have.

I am prejudiced, of course, but with good



Diagrammatic view of the interior of the Ark showing the ingenious arrangement of living and sleeping quarters, and equipment of home comforts with no waste space



Interior view of the Ark, looking toward the front, showing refrigerating machine, electric stove, stained cabinet and other modern household appliances.



How the luxurious sitting room is transformed into berths. The seats at left are converted into a bed seat to right, with curtains extending from the roof to the floor.



A light lunch on the road. This view looking forward in the Ark shows convenient drop tables, electric lights in the ceiling, and the radio loudspeaker at the far end. A two-pack pair of chairs and a table.

reason. For restoring restored my health to me many years ago and has kept me in good health ever since. I had been troubled with insomnia. Nothing that I did seemed to afford me any relief. Then, almost providentially, the motor car came along. In the early days of motoring I bought a small car, from which my Ark is a logical development. In the succession of cars that followed that first one I have toured many parts of the country, mostly over highways that were little traveled.

Driving through the open spaces, drinking in fresh air, feasting my eyes on the marvelous scenery, triumphing over small difficulties and adventures and performing the work necessary to keeping a car running under rough usage—these things banished my insomnia and made me an incurable devotee of motor touring.

I found out, too, what real delight there is in pitching a tent on the bank of a stream and camping there to fish and rough it. When a man learns to do his own crude camp cooking, he gets a keen relish out of his food, a relish that is absent from the most tastefully served meal he can order at a hotel. Those who have eaten fish whipped out of a brook, cooked above a hastily built fire and served up in regular camper's style, know what I mean.

Camping Trailer Led to the Ark

I became so fond of camping that a camp outfit became a most essential part of my touring equipment. To carry it better, I hitched a trailer on my car about five years ago. That worked satisfactorily for a time, but after the novelty had worn off, the trailer became a white elephant rather than a convenience. Looking around for something to substitute for it, I hit on my Ark idea.

The Ark has a wheel base of 198 inches,

and carries a 45-horsepower motor. Its tires are 36 by six, each of the rear wheels being equipped with two. Complete, the car weighs 11,000 pounds.

How to Buy a Home

FOUR fascinating adventures in home ownership, answering in understandable language the thousand and one problems that usually confront the prospective purchaser, will appear in *POPULAR SCIENCE MONTHLY*, beginning next month.

In four articles of a series, to be published in consecutive issues, the science of home buying and home building will be explained in a comprehensive and entertaining way by one of America's foremost writers on popular architecture—Phil Madison Riley. Here they are:

1. How to Buy a Ready-Built Home
2. How to Finance the Purchase of a Home
3. How to Build a New Home
4. How to Equip the Home for Comfort

Whether or not you are planning your own home this year, you won't want to miss any of this extremely useful and interesting series.

and carries a 45-horsepower motor. Its tires are 36 by six, each of the rear wheels being equipped with two. Complete, the car weighs 11,000 pounds.

One piece of personal equipment that I carry in the Ark, as I have carried it on all my motor tours, is a camera. A photographic diary of an extended motor trip permits you to live through your trip and enjoy it again, whenever you wish.

Plan that Summer Tour Now

Spring and summer, ideal times for motor touring, will be with us soon. If you have a car, or if you are contemplating buying a car, start making plans right now for a real tour in it before this coming summer ends. Pick out a route that will take you away from the inhabited places. Get a camping outfit and sleep in the open. Take a camera along and let it keep a diary for you. Thousands of people in the United States are doing that every year. They are getting real value out of their cars, even receiving dividends in the form of health and happiness on what their cars cost them.

Fireproof Wall Lining Made from Waste Lumber



Part of the factory at Cloduit Mills where fireproof "wood" is manufactured from waste.

HOUSEHOLD fuel bills can be cut from a quarter to a third, it is claimed, by insulating the walls of the home with a fireproof "wool" now being made from waste lumber at Coonapet, Minn. This material is said to be nearly as effective an insulator as pure wool, which, of course, is too costly for building purposes.

The insulator is a flexible blanket made of spruce lumber waste cemented together and packed between two sheets of asphalt-lined, tough, waterproof paper. The waste is chemically fireproofed first, and then thoroughly dried by fans and several miles of steam pipes. Shredding machines macerate it thoroughly, this



Testing the fireproofing of the new material with a blowtorch. It took 4 minutes for the flames to reach the material.

Finally, it is cemented with a special adhesive, dried and packed between the sturdy covering sheets. These previously have been coated on one side with a film of hot asphalt that cements them to the

Applying the insulator to a wall. The strips, 16-1/4 inches wide, are said to fit snugly between the studs, automatically forming flanges along the sides and ends. These flanges are held tightly against the studs and joints by batts of insulating strips. Thus every crevice is sealed tightly.

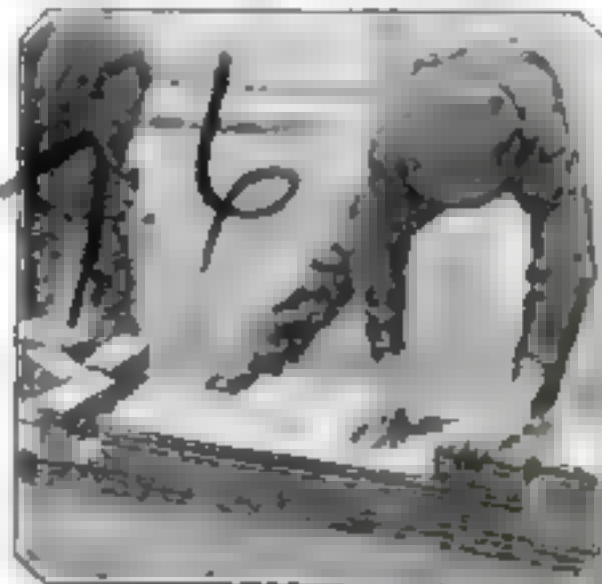
The finished product is said to be light, flexible, and easy to apply. Because of its flexibility it accommodates itself to settling or vibration of the building framework.

The effectiveness of the fireproofing was demonstrated strikingly when, in a recent test, a blowtorch required four minutes to penetrate the material. The chemicals in the fireproofing are said to have extinguished the fire soon after the torch was withdrawn.

Noiseless Street Paved with Rubber Bricks

THEIR is one street in the world through which the heaviest traffic may pass without noise. It is a street called "Holborn" in London, England, which has not been paved with rubber blocks. Mr. E. P. Spurrell, borough surveyor, supervised the installation of this novel pavement, of which he is the inventor.

The rubber bricks are similar to the wood blocks extensively used in street paving and measure 9 by 4 1/4 by 3 inches. It is expected that they will last for at least 15 years and they can be manufactured for the same price as ordinary creosoted wood blocks.



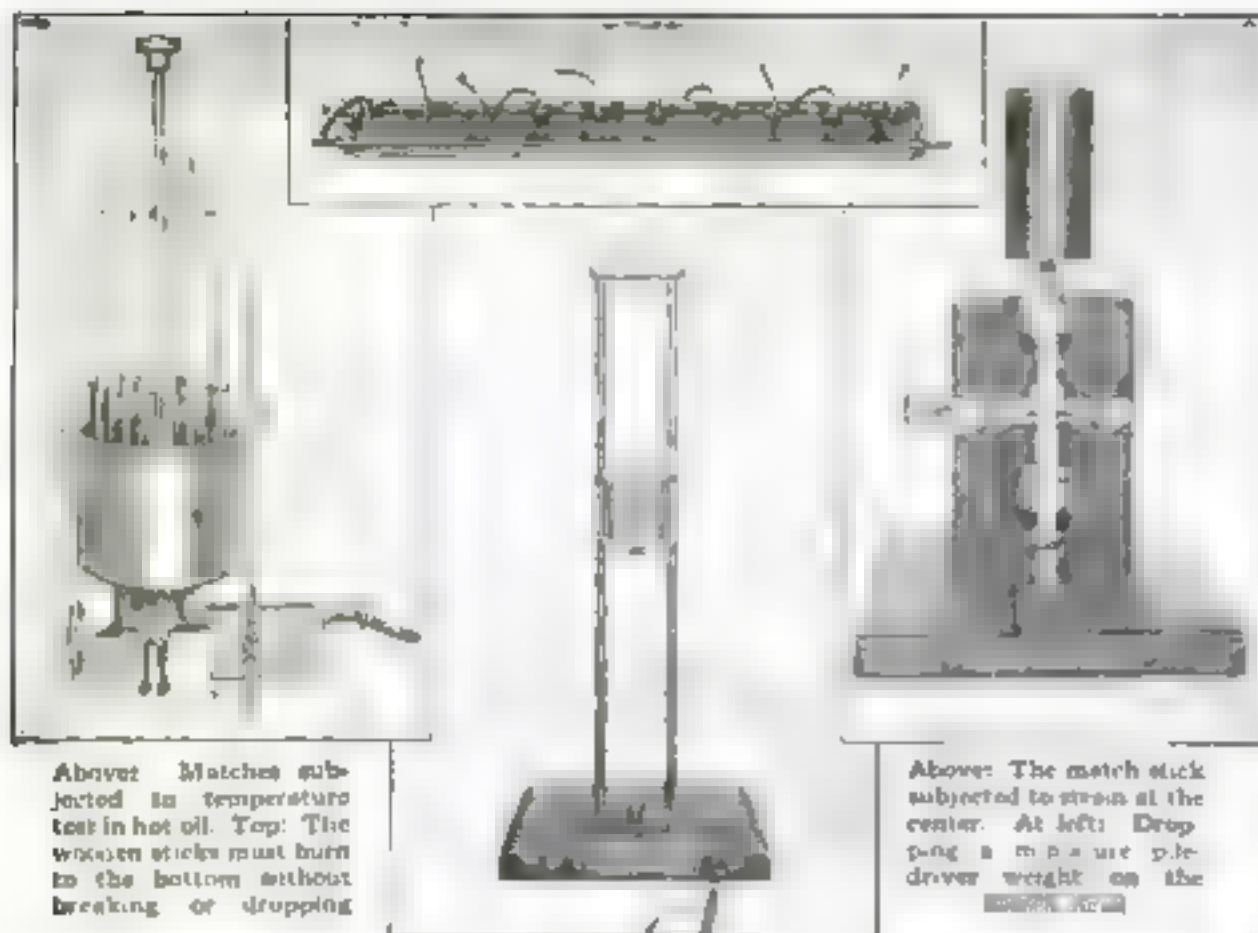
Workmen pour it in a street in London, England, with rubber beams. These blocks are shown laid at the left. They are grooved at the sides and are laid so that they fit into each other on a solid concrete base.



An Ice-Cream-Can Opener

THE difficulty encountered in raising the emergency cover has been frozen fast has led to the design of this cover, a better opener in a large scale, with a long upper jaw and a short lower one that hooks under the rim. The lid is raised with little effort.

THE Editor will be glad, wherever possible, to supply the names and addresses of manufacturers of devices mentioned in Popular Science Monthly. Letters of inquiry should include the month of issue and number of the page on which the device is mentioned.



Above: Matches subjected to temperature test in hot oil. Top: The wooden sticks must burn to the bottom without breaking or dropping.

Above: The match stick subjected to strain at the center. At left: Dropping a pile driver weight on the match.

How Science Tests Matches for Your Safety

THE pleasure match, common, cheap, yet sometimes capricious, receives respectful treatment from the United Writers' Laboratories. Above are pictured scientific tests by which the laboratory investigators keep your matches safe for you.

First, several of the matches on trial are placed in tubes equipped with thermometers and resting in oil. The oil then is heated until the matches ignite. If ignition occurs below a temperature considered safe, the matches stand condemned. They could not, for example, be kept near stoves.

Next, 10 matches are inserted shallowly in sockets along a metal testing bar, and lighted. They must burn to the bar without dropping burned heads or bits of

chemical. Unless they pass this test, one of their brothers some day might cause a disastrous blaze by dropping unobserved a lighted or glowing head.

A match now is laid with its head on a tiny metal pedestal, its wooden body resting in a groove of an adjacent pedestal. The match head is directly beneath a sliding weight that resembles a pile driver. This weight is such that a safe match will not ignite when struck at the end of its fall.

Finally, a match, supported at each end, is strained by a gradually applied weight. If the wood remains uncracked, the matches are not likely to break in two when struck, so that the blazing end might endanger curtains, paper, or hair.

New Weight Machine Measures Pull of Horses

BY MEANS of a weight-lifting machine, the pulling power of horses, as well as the effect of various road surfaces on it, has been determined with great accuracy by the Horse Association of America. The machine, called the "dynamometer," is the invention of Prof. E. V. Collins of Iowa State College.

At the recent National Horse Show in New York City, Bob and Pete, a team of 10-year-old truck horses, weighing together 3500 pounds, accomplished a pull equal to lifting 2450 pounds from a well, a feat said to have astonished veteran horsemen.

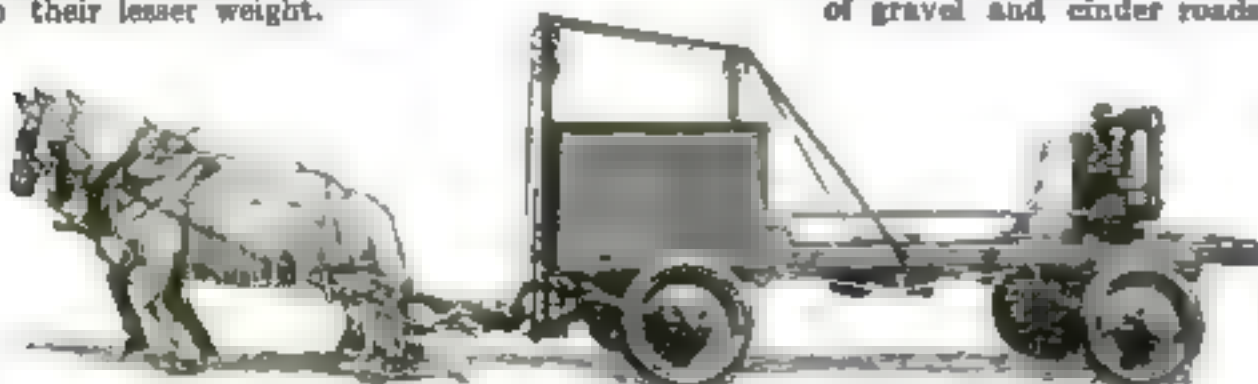
In other tests a team of mules, weighing 2600 pounds, failed to raise a 2000-pound weight, this being attributed to their lesser weight.

The tests are said to have demonstrated that horses can pull from six to eight times as much as usually is required of them, particularly on city pavements.

Old and worn brick paving was found to require a tractive pull of 290 pounds—almost two horsepower—for a wagon and contents weighing six tons, while new and smooth brick paving required only 200 pounds, about 1 1/3 horsepower.

On asphalt paving the required pull increased to 560 pounds, or 4 2/3 horsepower. Concrete paving was found the least exacting.

Dirt roads, apart from their greater ease to the horses' feet, demanded greater pulling power than did roads that were paved. The same was true of gravel and cinder roads.

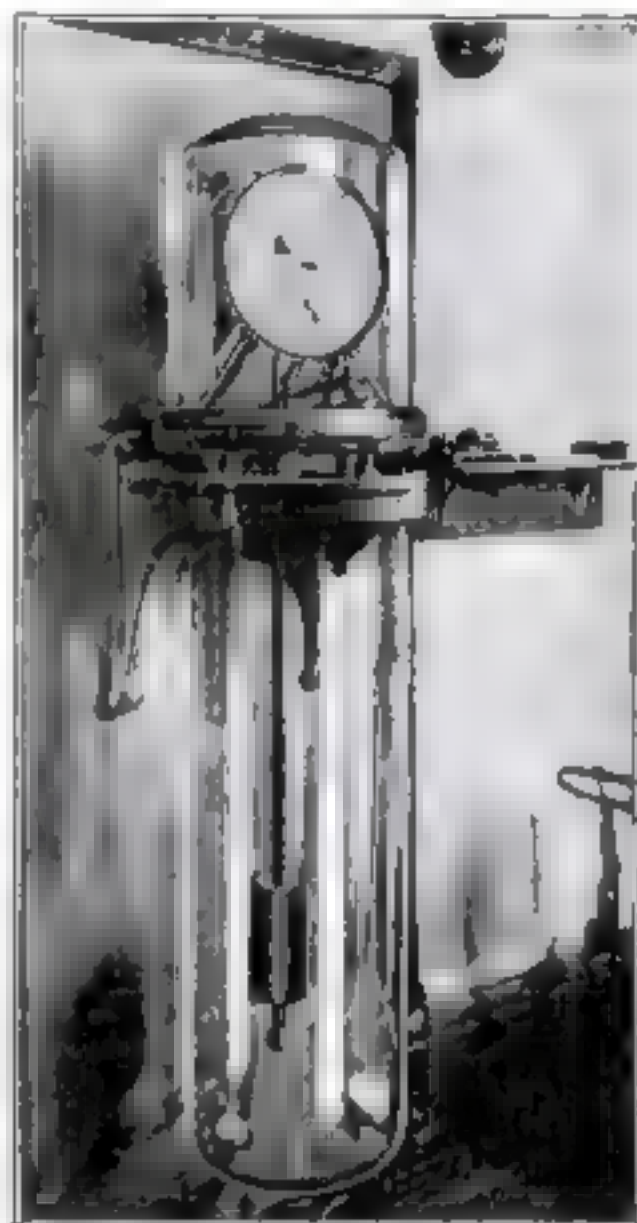


Measuring the pull of a team of truck horses hitched to the weight-lifting machine.

Most Accurate Clock Ticks in Airtight Room

A CLOCK that has varied less than one second in 2 1/2 years ticks off the hours in the Case School of Applied Science, Cleveland, Ohio. It is said to be the world's most accurate timepiece.

It is mounted in a special airtight room, surrounded on all four sides, ceiling, and floor by four-wall partitions, which provide three separate air spaces. Its foundation is a stone pyramid, which in turn rests on a concrete base 16 feet square. Beneath this concrete is the natural shale upon which the building rests. Thus approximate freedom from



This clock at the Case School has varied only a fraction of a second in 2 1/2 years.

vibration is achieved. This room is entered through a temperature trap with four doors.

Accuracy is enhanced by the fact that only a suspended ribbon of spring steel gives contact between the counting mechanism and the pendulum. The latter is an alloy of nickel and steel, which is declared to be almost undetectably affected by temperature changes. Automatic winding is accomplished electrically every 32 seconds.

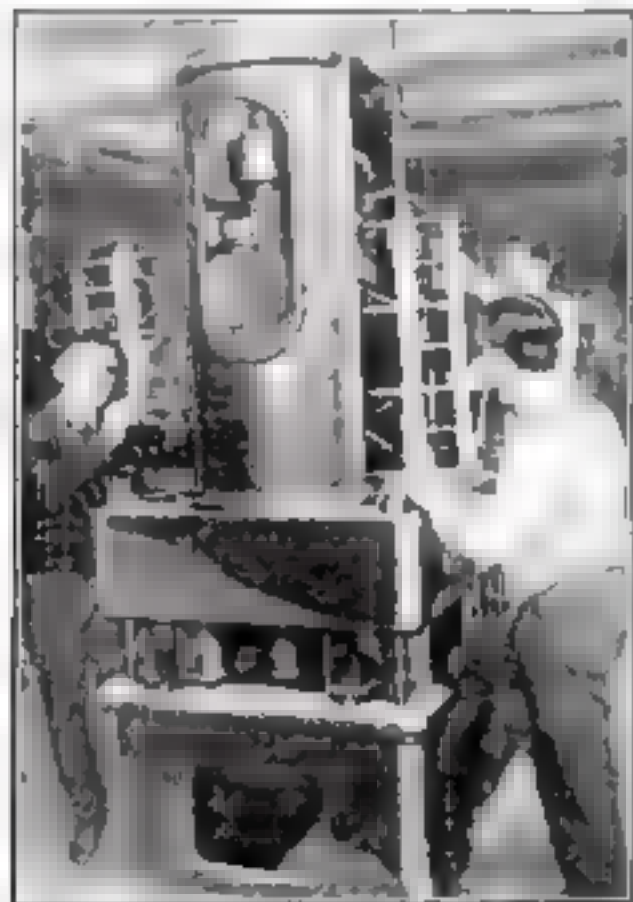
The air through which the pendulum swings is rarefied by a pump that automatically compensates for temperature changes. A change of one millimeter in air pressure, it is said, would vary the clock's rate more than one hundredth of a second a day.

OWING to the large number of contributions in the contest, "Why I Value My Hobby," it is impossible to announce the prize-winners this month. The announcement will appear in the April issue.

University Offers Course in Airplane Design

THE first college course in airplane design and construction to be offered in the United States has been launched at New York University, New York City. A surprisingly large enrolment attested the demand for such instruction.

The innovation has been indorsed by President Coolidge and high army and



Testing lifting power of airplane wings

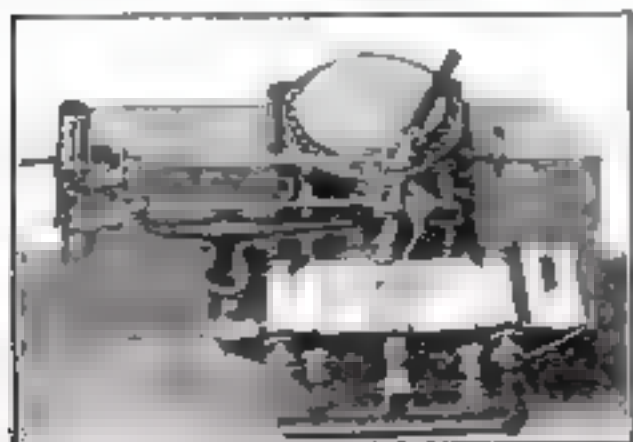
navy officials, who have expressed the deep hope that it may result in American leadership in aeronautical construction and performance.

The photograph shows students in the laboratory of the university testing the lifting power of an airplane wing by subjecting it to high pressure. The course is under the direction of Prof. Alexander Klemin and a corps of technical experts.

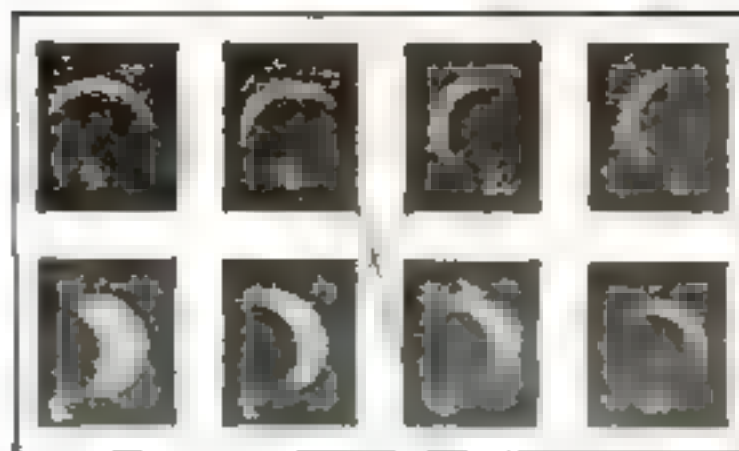
Mechanical Aerial Pilot Measures the Wind

PRECISE measurement of the drift of an airplane off its course by the wind, is said to be possible with a new instrument, designed to measure wind velocity and to indicate the true course of an aircraft.

It determines instantaneously the angle at which the aviator must fly to windward of a straight course in order to reach his destination without having to turn back from leeward. This measurement is automatic.



Wind-measuring machine guides air pilots



Eight stages of solar eclipse showing passage of the moon's shadow across the sun from right to left

Eclipse Photographed by Homemade Camera

FOR seven foot boards, three lenses from old spectacles, some black burning paper, a camera shutter from which the lens had been removed were combined by George Tauchmann, of Berkeley, Calif., into a homemade astronomical camera with which he took excellent photographs of the recent solar eclipse. These photographs are reproduced above.

The boards formed a six by six inch box, which the black paper lined to keep the light off the inside walls. The three spectacle-lenses then were laid on each other cross-wise and were bound with white friction tape to keep them together. This tape also was used in fastening the improvised lens to the front opening of the



George Tauchmann, of Berkeley, Calif., standing beside his homemade astronomical camera. At the left: How three spectacle lenses were fastened over the camera shutter

shutter. Part of this tape went away in the accompanying illustration to show the glasses more clearly.

A half-inch opening, about 1/170 the length of the focus, was used and an exposure of 1/25 of a second given each picture.

Invisible Writing Made Visible by Detector



The inventor with his writing detector

MANY a precious literary relic may be recovered, after centuries of oblivion, by a new German method designed to make visible papyrus and parchment writings that apparently have been obliterated. This method also may be applied to military intelligence and scientific crime detection by revealing invisible writing.

Thousands of ancient manuscripts were erased during succeeding centuries so that the papyrus or parchment might be used again. Papyrus writing was erased by passing a wet sponge over it, and parch-

ment writing by rubbing it with pumice-stone.

It was to recover this lost literature that Prof. H. Kogel, of Karlsruhe, Germany, invented the new detector.

Parchment and papyrus belong to a class of substances that give off a faint yellow light when exposed to ultra-violet rays. When such rays are directed at one of the ancient manuscripts, all but the parts once wetted with writing fluid are said to give off this yellow light, making the invisible writing visible.

Quartz instead of glass is used in the detector because glass absorbs ultra-violet rays. A quartz lamp produces the rays, while two quartz prisms spread them in a long spectrum on a screen about 10 feet away, after sending them through a narrow slit.

ut a uro papyrus uerbarre ex quo
umple iAud a salomunc edicatum
e factum regu filie uirgine de
pphacur a iudica fcedoru expor
fau demagne ac mupley camerum
tam uemari ad legem Fera rem

Papyrus writing revealed by the detector



This Indoor Football Game Requires Kicking Skill

A NEW game of indoor "soccer" football has recently been invented by Percy Mason, of Sutton, near London, England. It is the devotees of the kicking game a popular household version of the sport. It is said to afford much of the excitement of offensive play and skilful passing across the field that is found in the outdoor game.

The game is played under a net, which is mounted upon a rigid support in such a way as to allow each player sufficient

room between the net and the floor for him to insert his foot. Each player therefore has a limited field of action, and a considerable amount of skill and practice is required before he can learn to use this small space to best advantage.

World's Smallest Fishes

PROBABLY the smallest species of fish in the world—the smarapan—is found near Luzon, Philippine Islands. It weighs half a grain, and is half an inch long.

World's Greatest Aquarium Has 57 Tanks

WHAT is said to be the world's most perfectly equipped aquarium was completed recently in Golden Gate Park, San Francisco, at a cost of \$300,000.

Fifty-seven ponds and tanks are pro-

vided for an unusual variety and number of fishes. Thirty ponds and aquaria will contain other marine creatures. There are also tanks for reptiles and a small pond for turtles, snakes and toads.

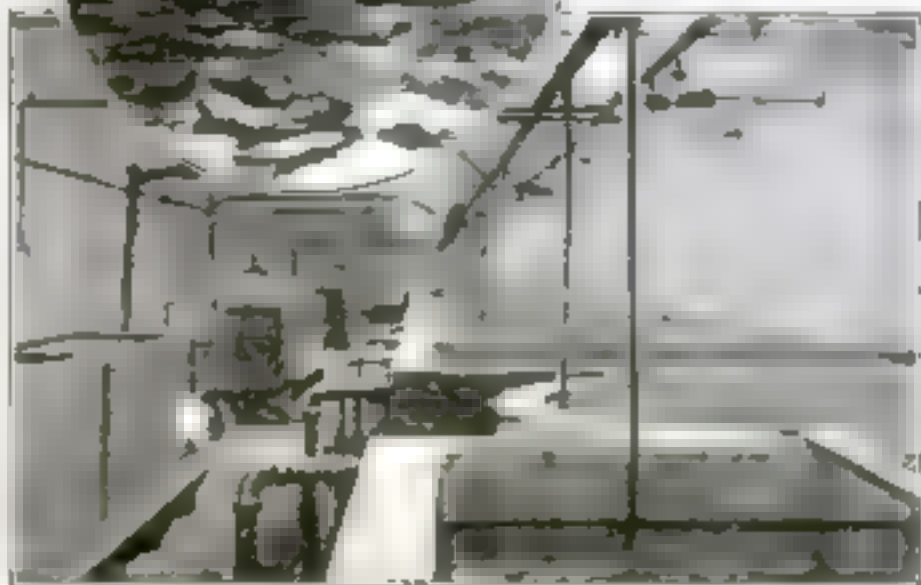
A complete heating plant and a complete refrigerating plant supplies warmed and cooled water for tropical and arctic fish respectively.

An extensive biological laboratory and a thoroughly equipped laboratory will afford students and research workers unusual opportunities. A large collection of stuffed fish and other marine animals will supplement these facilities.



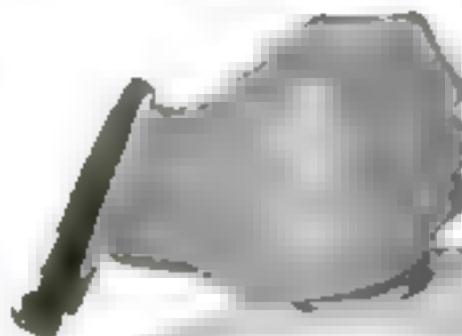
One of the large tanks in the new San Francisco aquarium is shown above. The picture on the right shows one of the numerous ponds for the use of sea seals.

At the right: A view of some of the 57 tanks for fishes, showing the pipes that convey water from heating and refrigerating plants that keep it at correct temperature.



Convenient Notary Seal Resembles a Watch

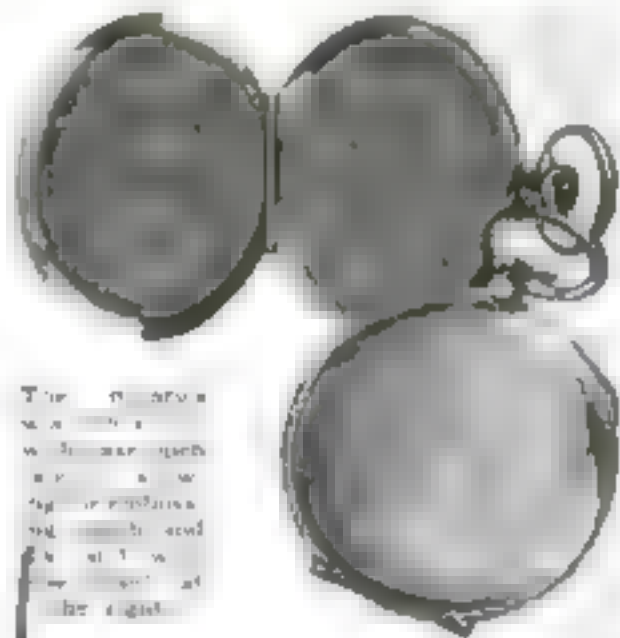
A NOTARY'S seal that resembles a watch now is available for notaries who travel or who for other reasons often are called upon to seal documents away from their offices. It can be carried either



Pressure or a slight blow on the case makes the impression.

in the vest pocket, as a watch is carried, or in a lady's purse or handbag.

To seal a document with the device, one opens the case, inserts the paper and then closes the seal. Pressure with the fist, or a slight blow, will effect the desired impression.



Dentist's Pistol Designed for Filling Teeth

YOUR dentist soon may be filling your teeth with this compressed-air pistol, a recent Australian invention that discharges gold or amalgam into the cavity.

Pulling a trigger opens and closes a spring-controlled valve in a channel extending through the handle of the device



Pulling the trigger discharges the filling metal.

into the cylindrical chamber. In this chamber a wind wheel, or rotary fan, is whirled by the force of the air pressure conveyed in the tube to which the pistol is attached. When the trigger is pressed, the rotating fan discharges the gold through the small barrel.

The instrument is said to replace the slower method of picking up the filling material particle by particle.

Self-Inking Drawing Pen Makes Uniform Lines

FOR architects, artists, and others who do drawing or lettering involving lines of various thicknesses, a new self-inking fountain pen has been developed. Eight points of contact, each connected with a separate reservoir, are provided in the pen, permitting it to draw lines as thick as a pencil. A plunger at the tip of which is a spongy ball, presses the tip of the pen into the hollow interior, which is filled with ink, is said to have greater capacity than most pens made for this purpose.

Using the pen pushes in the projecting tip of the plunger, releasing ink in a con-

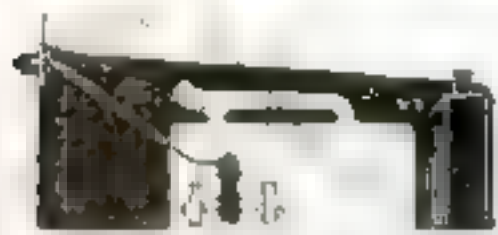


Louis Reichart at work on the auto alarm clock that he has devised

Novel Auto Lock Sounds a Warning Rattle

A STARTLING surprise awaits the thief who attempts to steal a car equipped with a new reflecting device that causes a betraying chatter, loud enough to be heard several blocks, as soon as the car is started. The device is the invention of Louis Reichart, a construction engineer of Philadelphia, Pa. It weighs but a few ounces.

Unlike other alarm devices that depend on a lock or on current from the battery



Installation of lock and dash control

this invention can be silenced neither by a thief's key nor by disconnecting wires.

A toothed wheel is attached to any exposed shaft, upright or vertical, on the engine. A spring tongue engaging the wheel is controlled from the dash by a keyless lock capable of an infinite number of combinations. When the owner leaves the machine, he sets the lock, causing the tongue to engage the teeth of the wheel. Any attempt now to start the motor, by causing the shaft to rotate, will set up the chattering that betrays the thief.

A split aluminum housing guards the entire assembly, which, of course, is mounted on the shaft. The device is said to function on right- and left-hand motors.

Declares Ants Are Toppers

ANTS consume more alcohol in proportion to their body weight than does the most accomplished "old soak," asserts Prof. Paul Lindner, chief of the Fermenting Industry Institute in Berlin, Germany. The industrious insects manufacture their own home-brew in their digestive canal by the action of yeasts on the milky juices that they extract from aphids, or plant lice, which they keep for that purpose.

Other insects have similar homemade home-brew outfits that they use to "sparty," Doctor Lindner stated. Wasps, accomplished bootleggers



Lettering outfit, showing interchangeable pens

stant flow and insuring a uniform line independently of the pressure applied.

A set screw on the point permits adjustment of the drawing angle to individual preference. The pen also is adapted to follow the edge of a T-square and to be used as a ruling pen.

Dump Carts Supplanted by Aerial Railway

BECAUSE the disposal of valuable earth by cartage proved expensive, an Iowa clay products company has constructed an unusual aerial railway running to the dumping place.



The aerial railway



Sandpiper Gives Warning of Person in Lock



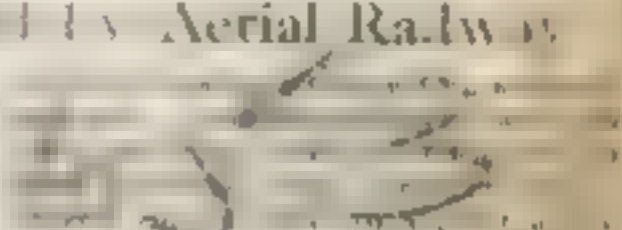
Metal Trap for Insects



Trapping insects



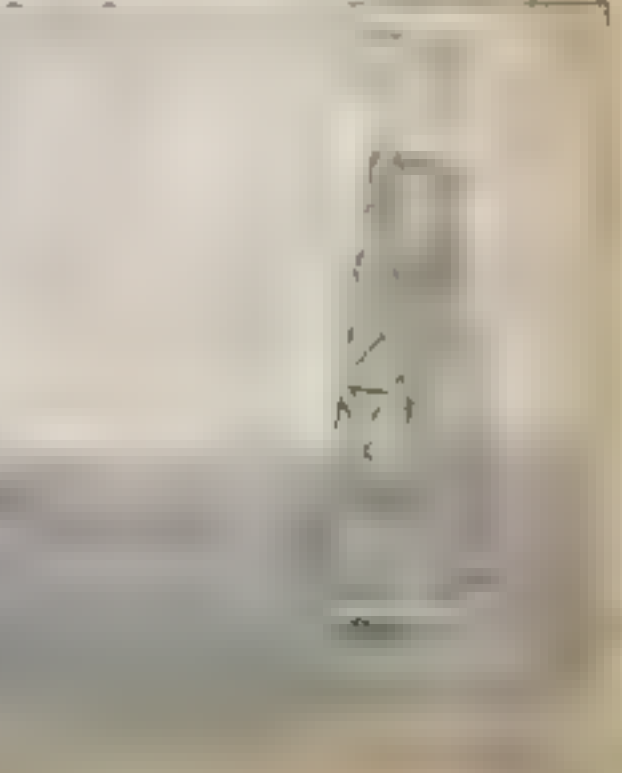
Trapping insects



Trapping insects

the dumping space. The car, when it stops the car, and the operator, by means of a lever control, dumps the earth to the dumping place.

This method is said to have enabled the company to dispose of about three cents a yard.



Trapping insects

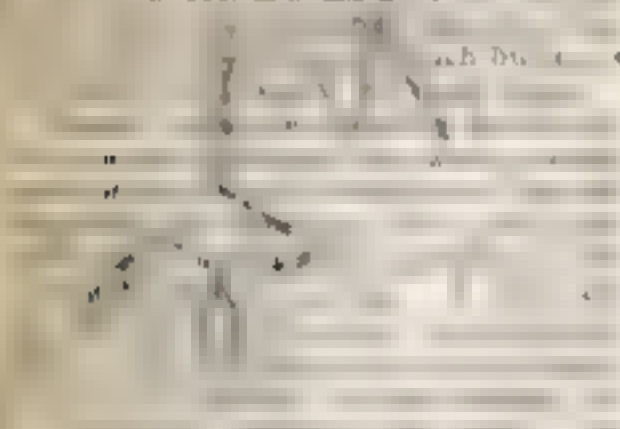
Indicator Locates Faulty Spark Plugs

automatically indicates
1 to reveal instantly



not fault and what is wrong
has been made

The indicator is fitted with



Gas Replaces Steam in Replacing Exhaustive

gasoline



Any Electric Fan Screws into Light Socket

FOR muggy summer days,
a portable electric fan, one
than a man's hand, has been
designed by a New York
inventor. The pitch of
the fan blades is
adjusted so that the
motor can be screwed
into a standard light
socket.



The marked
pitch of the
blades is such
that the fan
can be used for
lighting as well
as for cooling.
This nifty fan
can be used
of the usual
size. A similar pitch of an ordinary fan
would tend to topple a man.

The new fan can
be used for lighting

Merchant Uses "Stand-Up" Desk to Keep Well



George Lytton working at his desk

THE NEW YORK
INVENTOR HAS
DESIGNED A
PORTABLE
ELECTRIC
FAN WHICH
CAN BE USED
FOR LIGHTING
AS WELL AS
FOR COOLING.
THE PITCH OF
THE BLADES IS
ADJUSTED SO
THAT THE FAN
CAN BE USED
FOR LIGHTING
AS WELL AS
FOR COOLING.

Convenient Tray Designed for Berry Picking

A NEW berry tray designed to permit picking of berries without the vines or leaves being torn by George H. Owen, of Amesbury, N. H.



Both hands are left free for picking

The device has an arched side resting against the picker's body and an inner section, removable by a handle, into which two berry boxes fit.

The entire device is supported by a cord about the neck and shoulders of the berry-picker. The handled inner section may be lifted out when filled and

replaced with one containing two empty boxes. The invention is said to be comfortable to carry.

Two-Piece Tire Rim Said to Eliminate Bolts

A TWO-PIECE tire rim, said to eliminate bolts, screws, rings, and rivets, is one of the latest contributions to the convenience of motorists.

The main rim has a recess extending halfway around the circumference, into which a tire locking piece fits. The locking rim is slipped between the outer face of the main rim and the bead of the tire. Both beads of the tire rest on it.

Rivets are set in the outer edge of the main rim, and corresponding lugs are on the locking section. These lugs seat themselves in the pockets when the locking section is pushed into place, holding the tire securely.



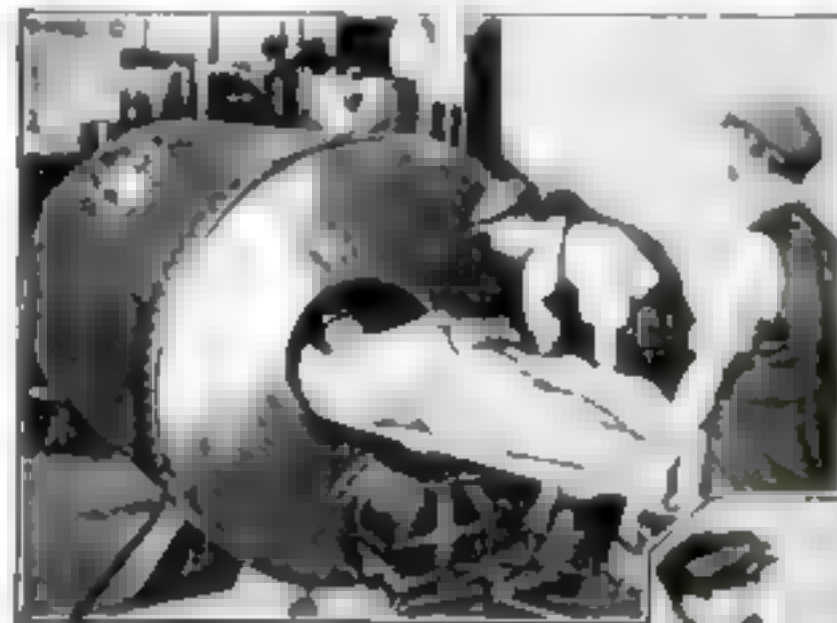
Fastening the tire with locking rim



Airplane "Hooks a Ride" on Army Dirigible

WHEN an airplane, flying 60 miles an hour, caught with a hook the lowest rung of a wire ladder suspended from the army dirigible, it was a reality. The army dirigible, the Army Air Corps, Va., recently, the dream of carrying fighting planes became reality.

As a motor ship could carry planes as a defense, or for an aerial attack. The use of suspended rings on the dirigible, instead of ladders, has been proposed. The dirigible would carry supplies for the planes and furnish quarters for their men.



At the left: Demonstrating the use of a compression chamber into which a diver who has come up too quickly from a great depth is placed to prevent the dread caisson disease.

Below: A student diver donning a diving helmet for a plunge into the training tank at London, Eng.

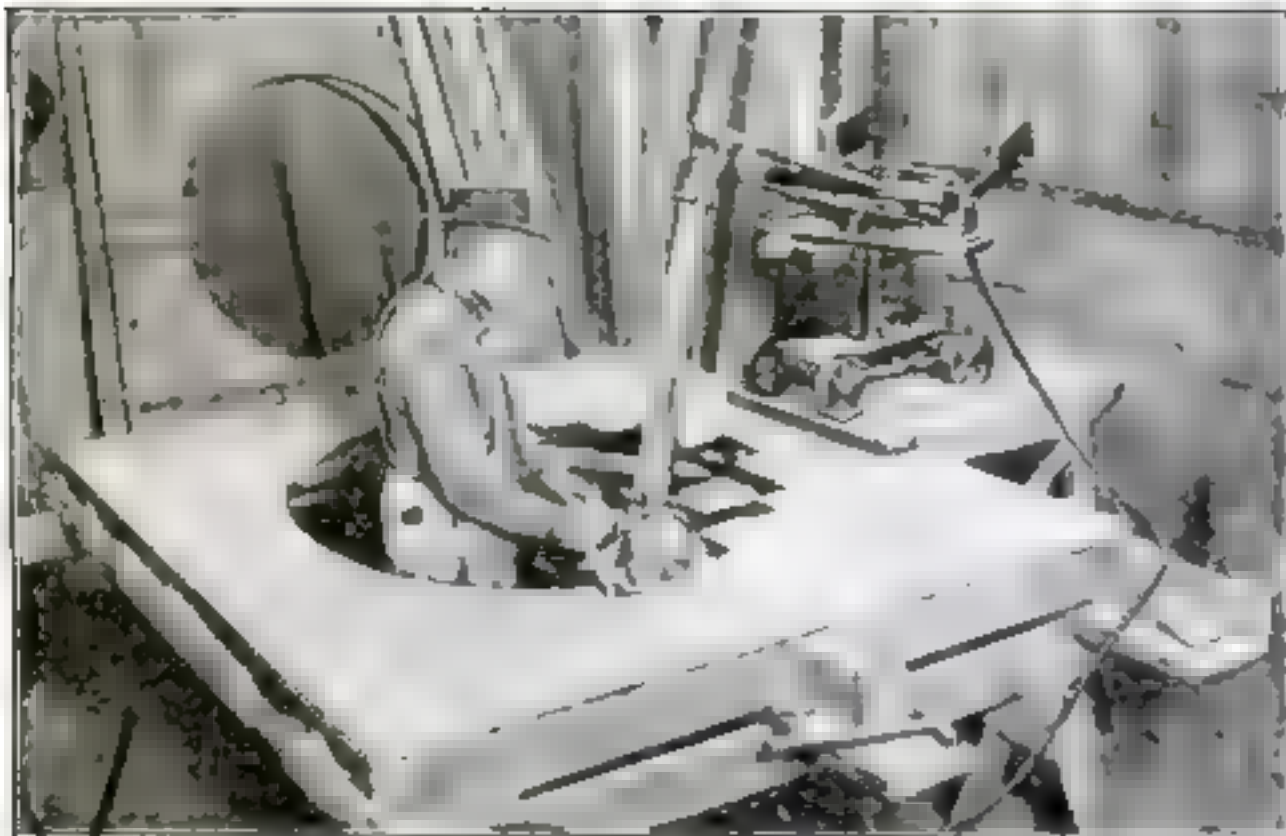
Deep-Sea Divers Go to School in a Tank

HUNDREDS of divers employed since the war in deep-sea salvaging operations have been trained scientifically in an enormous tank built by a firm of salvagers in London to duplicate actual conditions encountered under water. In this tank they are given a complete course that is said to fit them for any diving feat they may be called upon to perform.

The equipment of the training school includes a compression chamber. Sometimes divers coming up too quickly from great depths are attacked by a type of paralysis called "caisson disease," or the "bends." This often proves fatal unless instantly treated.

The afflicted man is put into a compression chamber under a pressure equal to that of the lowest depth to which he has been just before the attack. The pressure then is decreased gradually.





Portable Electric Saw Cuts Inside Circles

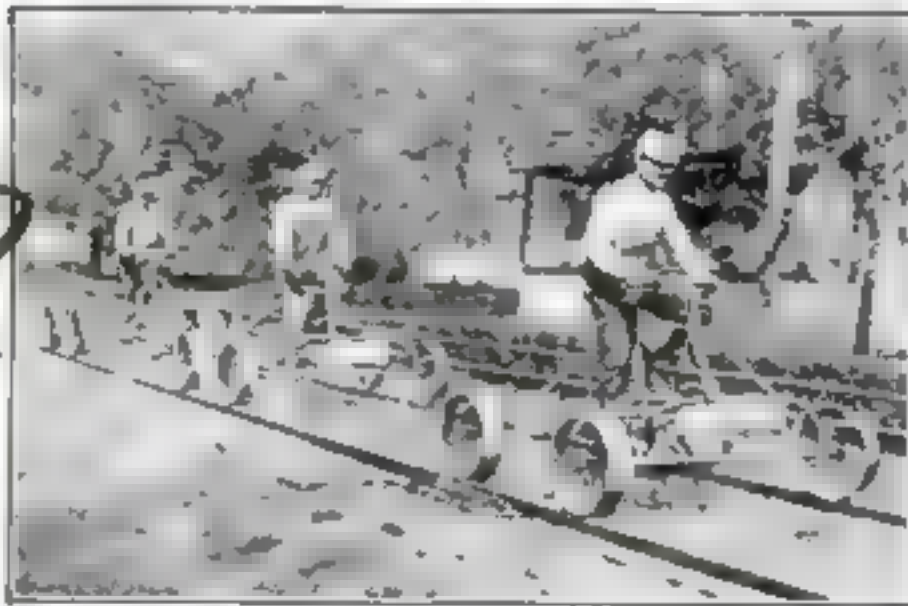
A VERSATILE and portable electric woodworking saw, embodying features hitherto said to have been found only in stationary mill saws, is now offered builders and manufacturers. It is claimed to be particularly useful in making forms, or in mortising, chiseling, and planing. It will cut, measure, and square or bore from ends.

The machine is mounted on a four-wheel carriage with roller bearings, the

swivel post being carried on ball bearings. The sawing head is adjustable to cut any angle up to 55 degrees, a feature adapting it particularly to the cutting of jack rafters, as well as joists, studding, bridging, siding, and flooring. A radius rod, adjustable to different sized circles, permits the cutting of circular holes. The illustration above shows such an inside circle being cut for a column head.

Coal-Miners Ride to Work on Railway Cycles

FOOT cars—one-man cycles with flanged wheels for riding on a railroad track—carry the employees of a West Virginia coal mine to work. The long road the men must travel between the town where they live and the mine is this railroad line. The perfection of these unique cars is said to have saved the workmen nearly an hour a day. They are pushed by the sprocket driving the rear wheels.



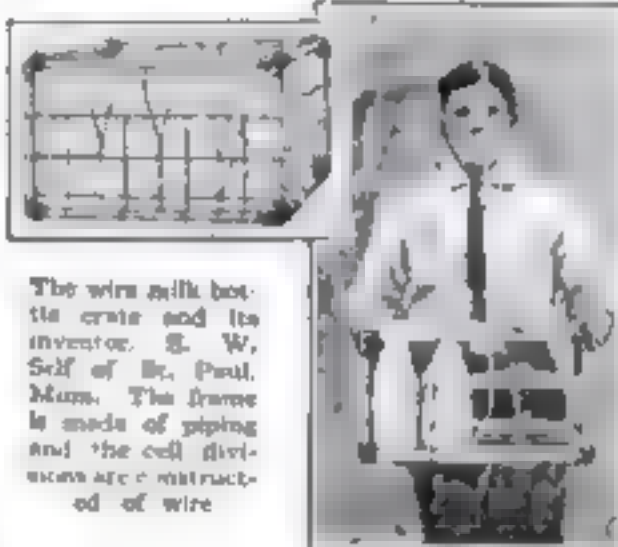
West Virginia miners riding to work on four-wheeled cycles

Sanitary Crate for Milk Bottles Made of Wire

A NEW milk-bottle crate for which are claimed the advantages of lighter weight, greater capacity, better sanitation, and longer life, has been invented by S. W. Self, a dairy worker of St. Paul, Minn.

The crate now generally used is, of wood, has solid sides and weighs from 13 to 18 pounds. The new crate, with a frame of piping and compartment divisions of galvanized wire, is said to weigh only eight pounds and to allow instant inspection of its contents. The pipe frame provides a handle all around the top, instead of the small slots or depressions that serve as hand grips at the ends of the usual wooden crate.

Since neither the galvanized wire nor the piping can become water-soaked, rusted, or easily worn out, the inventor believes the new crate will save many thousands of dollars for the nation's dairies.



The wire milk bottle crate and its inventor, S. W. Self of St. Paul, Minn. The frame is made of piping and the cell divisions are constructed of wire.

How to Keep Doors from Sticking in Dampness

FOR the householder who would avoid the nuisance of doors that stick in moist weather, the United States Forest Products Laboratory at Madison, Wis., points out the importance of painting or varnishing the tops and bottoms of doors—places often neglected because "they don't show." These hidden edges, if not painted, are vulnerable points where the wood absorbs or loses moisture rapidly, especially at the ends of the outside uprights where the wood grain is exposed.

HOW MUCH DO YOU KNOW ABOUT SCIENCE?

1. Will the brain work better in a warm room than in a cold one?
2. Why do flowers smell sweeter after rain?
3. Is there such a thing as a "criminal face," a "criminal mouth"?
4. How are storms predicted by meteorologists?
5. Why is it that certain diseases afflict a person only once?

ONE sure way to gain confidence in yourself is to understand the forces that move the world and the every-day things about you. Constantly situations arise in which ignorance of simple, yet vital scientific facts may place you at a disadvantage—even humiliate you. Knowledge of these facts, on the other hand, enables you to think, speak, and act with authority and confidence.

Our monthly science questions, culled from thousands asked by our readers, offer you the roots of an invaluable habit, that of adding steadily to your store of knowledge.

Do your best with these questions, then turn to page 157 for the correct answers.

6. Why is the sky blue?
7. Are there any lost arts?
8. Why does an electric current cause death?
9. What is the will-o'-the-wisp and how is it formed?
10. How can you make fresh water from salt water?
11. What is the largest snake in the world?
12. What makes the colors of precious stones?

Top of Gearshift Lever Serves as Pistol

A DETACHABLE pistol top for the automobile gearshift lever is a new invention for protection against highwaymen. By drawing back a slide with the thumb, a section of the lever is loosened. Withdrawal of this section from its position on the end of the lever automatically cocks the pistol. Pressure on a trigger near the operator to fire two shots in less than a second, it is claimed, without attracting attention by his movement.

Since the lever is within easy reach of the driver, he has an immediate means of defense in an emergency.



Releasing the pistol grip of the lever

Collapsible Wheelbarrow for Women Farmers

IN GERMANY, where, since the war, women have taken much of the farm work, a light, collapsible wheelbarrow has been invented that can be carried about easily.



The wheelbarrow in use and collapsed

How Northern Railroads Battle Snowdrifts

SNOWSTORMS are serious matters on railroads of Alaska and the Far Northwest. Unless prompt and vigorous measures are taken, a train may become so completely buried that only the warm winds of spring can rescue it. Along the Copper River & Northwestern Railway will be seen a remarkably effective new wing type snow plow, the recent invention of Charles Duster, one of the country's master mechanics.

A locomotive with a stout nose-type plow pushes a car equipped with a steel arm 18 feet long and tapering from four feet at the car end to 2 feet at the tip. This may be set at any angle horizontally or vertically by levers controlled by the operator. Two compound engines, supplied with steam from the locomotive, furnish the power.

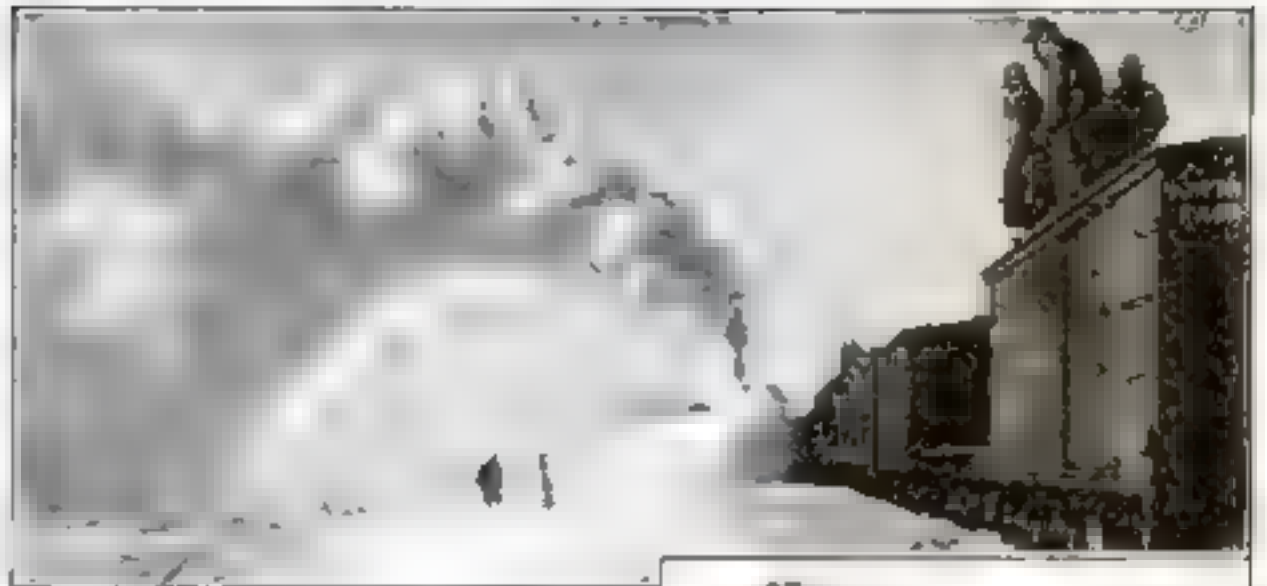
The plow on the locomotive piles the snow on both sides of the track. The steel wing then cuts down the tops of these banks, the snow sliding along the smooth, curved arm and dropping between the rails. A rotary plow follows, scattering this snow far from the roadbed. Thus high, collapsing piles are avoided.

Snow plows used on northern lines in the United States are of two general types. One, used for lesser accumulations and on comparatively straight stretches, has wings that curve out concavely, flinging the snow to both sides. The other is rotary, with blades that hurl the snow at right angles in a circular cloud. These rotary plows are more redoubtable fighters and can operate on the curves and steep grades of mountain stretches, plunging through high drifts and scattering them to the side of the tracks. The other type requires too much head-on power to do this.

Miners Guided by Smoke

MEXICANS working in a lead mine in Chihuahua, Mexico, have found a new use for cigarettes. The mine consists of a series of caves, along the sides and bottoms of which lead and silver ores in paying quantities are found.

The miners have noticed that smoke from their cigarettes is sucked through cracks in the rocks at certain points. By drilling in the wake of the smoke, they find another cave. This method of tracing ore was followed through many caves.



Top: Rotary plow in action. Center: View of blower. Bottom: New wing type plow

Ingenious Foot Plow Is Hauled by Man Power

LEG-POWER plowing is accomplished by the ingenious but remarkable apparatus invented in Germany and pictured below.

Pressure on foot lever raises the nose of the device, while a toggle joint causes the nose to be dropped a short distance ahead of its former location. The operator then pushes forward on a bar that pulls the plow a distance equal to the forward movement of the nose.



Hand and foot levers drive the plow

Pathfinders and Their Work

New Discoveries that Add to Our Useful Knowledge

The amazing structure of the world's scientific knowledge is built of an infinite number of units—never-ending contributions from the busy minds

of inquiring men and women. On this and the following page you will read of discoverers who are increasing the sum of science for our profit

The Language of Animals

ARE dumb animals really dumb? Have they not, on the contrary, some way of communicating with one another that is beyond the power of man's senses to discern? Scientists long have puzzled over this question, and the theory has been advanced that animals—birds and insects too—communicate by uttering sounds with such rapid vibrations that the ear of man cannot detect them.

A way of putting this theory to the test was developed recently, it is announced by the Westinghouse Electric and Manufacturing Company, in the invention by Dr. Phillips Thomas of an electric ultra audible microphone, said to pick up sound vibrations that are much too rapid for the ears to hear. Besides promising to solve the secret of animal "speech," this instrument is said to have immediate practical value in permitting perfect voice transmission by radio or the telephone. Sounds heard through a radio or telephone receiver differ now from the sounds that enter the transmitter because the instruments are incapable of recording the more rapid sound waves.

Stimulating Plants

POPULAR SCIENCE MONTHLY told last month how science has put plants on the night shift, making them grow 24 hours a day by installing powerful electric lights in greenhouses. Now science is stimulating plants by drugs. Professor David Lumsden, of the Federal Horticultural Board, has discovered that the growth of various plants can be stimulated by ether, which may be inhaled by the plant or injected by a hypodermic needle.

While ether puts man to sleep, it is said to exert an entirely opposite effect on plants, even reviving them when apparently they are dead. Thus frozen rose plants are said to have grown green shoots in a few hours after a single "shot" of ether, and to have thrived remarkably thereafter, resisting plant diseases.

Electric Lamp Lighted by Radio

THE wireless telephone has girdled the earth. Will there be a similar development in the wireless transmission of electric power? It is the next step in the

radio world of 1924, for a beginning has been made that is quite as startling as the wireless signaling experiments of 30 years ago. Dr. Willis Rodney Whitney, of the General Electric Company, a few weeks ago lighted a 110-candlepower incandescent lamp by power transmitted by radio.



DR. NIELS BOHR, of the University of Copenhagen, winner of the Nobel prize for physics in 1922, is gaining increasing world recognition for his important discoveries of the nature and structure of atoms. At the recent meeting of the American Association for the Advancement of Science, his theory concerning the worlds and solar systems that lie beyond the range of powerful microscopes, was declared by scientists to be one of the most useful scientific tools ever placed in their hands for work of research and discovery.



MME. CURIE, co-discoverer of radium, lives not only to enjoy the highest honors bestowed on her by the President of France, but to see her great work carried on for relief of cancer sufferers. Simultaneously with the recent Paris celebration of the twenty-fifth anniversary of the discovery of radium, was held a ceremony inaugurating the Curie Foundation, an institution recognized as a public utility for consultation and treatment of all cancer patients, rich and poor alike, who turn to radium for aid.

Psychology and Education

BY ITS application to industry in late years, psychology has demonstrated its usefulness, recently declared Dr. Herman P. Shearman, professor of economics at Miami University. And psychology applied to education will cause a revolution in education within the next 50 years, he added. In other words, "after having devoted itself during the last century to the arts and to industry, science is now turning its attention to the primary forces of all, the forces of the mind."

Conquers Disease

SINCE the war the famous British pathologist, Sir Almroth Wright, has been seeking a cure for septicemia, a dangerous blood disease. At last he conceived the idea of performing a new sort of blood transfusion by extracting the blood of a healthy person, inoculating it with an anti-septicemia vaccine and injecting it in the veins of a sufferer.

Recently it was announced that this method had proved remarkably successful. Thus another disease is yielding to transfusion—a method now used in the control of almost 30 maladies.

Bird Sex Changed

TWO amazing instances of a complete change in sex in full-grown birds were reported by scientists a few weeks ago. Dr. Oscar Riddle, of the Cold Spring Harbor, N. Y., experiment station of the Carnegie Institution, told of a female dove that had become a male dove after groups of cells had been destroyed by a tubercular infection, then regenerated by nature.

A somewhat similar case is that of a Buff Orpington hen in the animal breeding research department of Edinburgh University, Scotland, which, after the age of three years, ceased laying eggs and took on the appearance and habits of a male bird of the species. These cases are regarded by scientists as being of enormous biological importance. They indicate, it is said, that the modification and control of bodily and mental characteristics in animals await only definitely directed efforts of scientific investigation, since no characteristic appears definitely fixed.

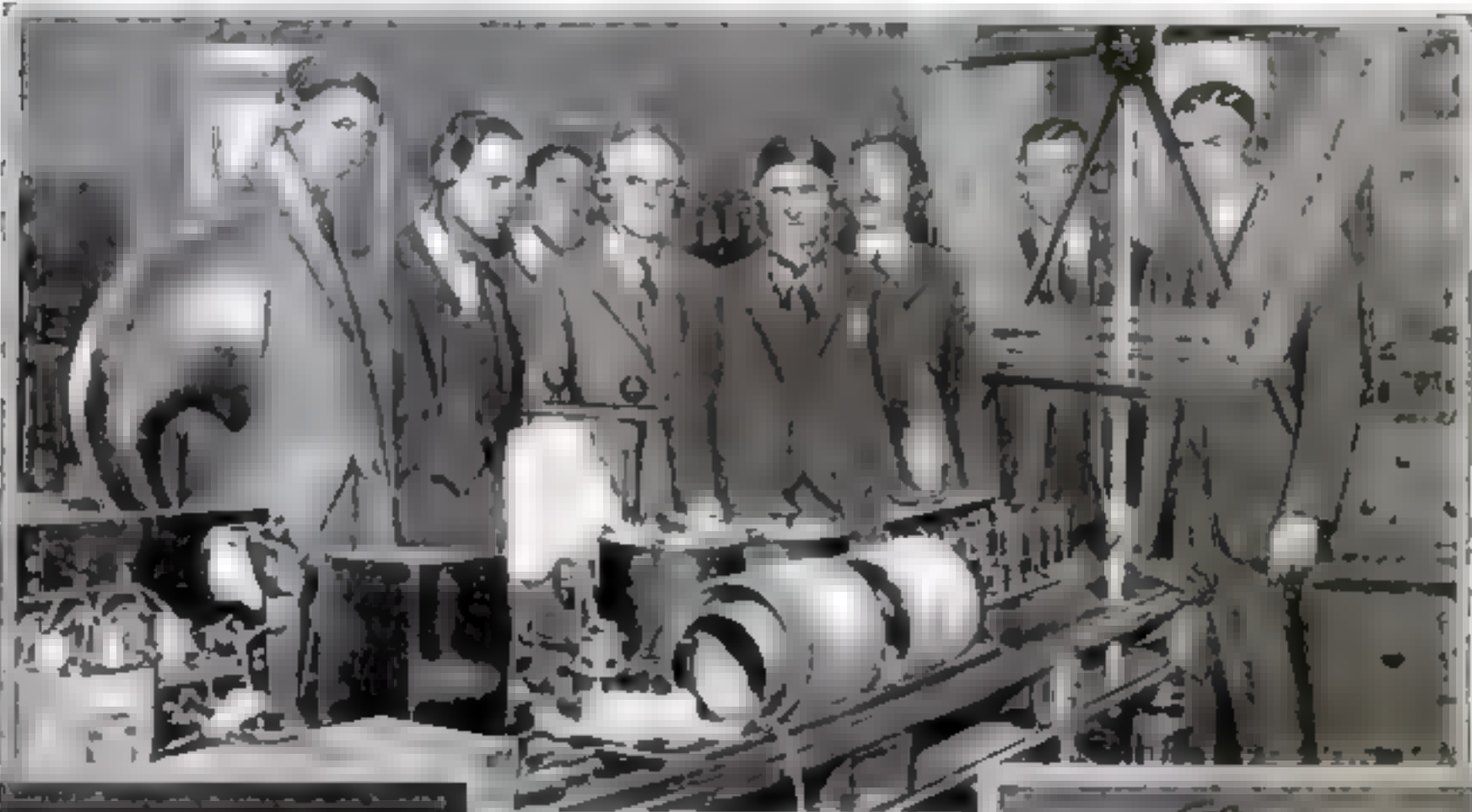
To scientists who witnessed the demonstration it was an event comparable with the beginnings of wireless telegraphy.

What Is the Earth Made Of?

MANY theories have been offered regarding the composition of the earth. The latest, as presented by Dr. E. D. Williamson and Dr. L. H. Adams, scientists of the Carnegie Institution of Washington, is as follows:

A small core of gold, platinum, and other metals heavier than iron. Around this, a 4200-mile sphere of iron or an alloy of iron and nickel. Next, a mixed layer of iron and rock, extending to within about 900 miles of the surface. Then a layer of rock. Covering this a surface crust, about 35 miles thick, consisting mostly of granite. These statements are based on a study of earthquake waves.

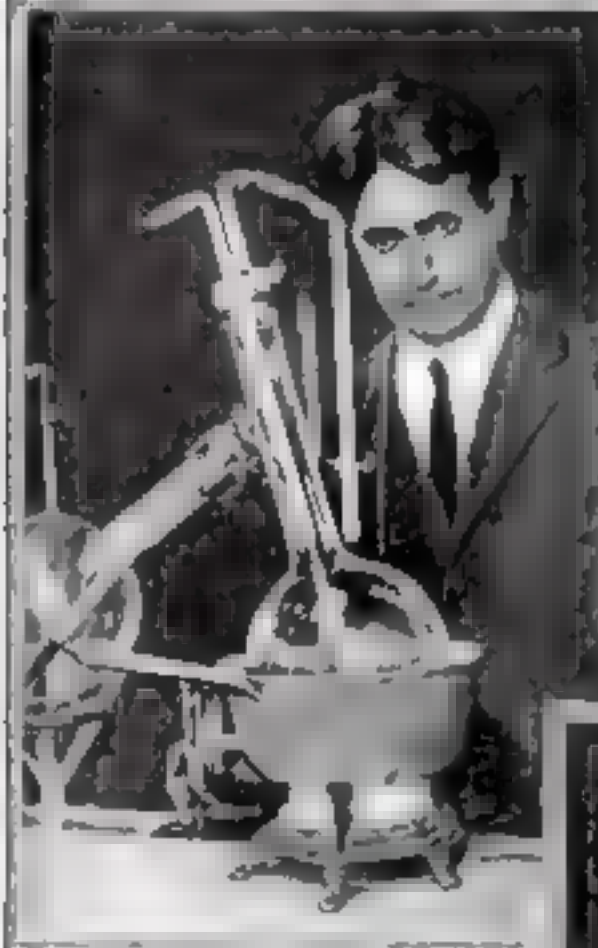
in the Progress of Science



—A—

DR. J. HARRIS ROGERS, discoverer of underground and under sea wireless, is shown above surrounded by radio experts, listening in for messages from London in the laboratory of his home at Hyatts ville, Md.

From left to right in front are G. E. Obver and W. L. Leach, radio experts of the Radio Corporation of America, Dr. T. E. Latimer, personal physician to Doctor Rogers, Dr. J. Harris Rogers, W. B. Flaherty, Western Union radio engineer of Washington, A. C. Doyle, Radio Corporation of America, D. H. Besty, safety expert.



DR. H. C. GORE, of the Bureau of Chemistry, United States Department of Agriculture, with the experimental apparatus by which he has discovered a method of converting corn into sugar, imitating the processes of the human stomach. He claims to get 33 pounds of sugar from a bushel of corn, converting all the starch contained in the corn into an equal number of pounds of sugar.



*Prof. E. Branly
Paris, France*



*Dr. D. W. Morehouse
Drake University*



DR. CLARENCE N. FENNER, volcano expert of the Geophysical Laboratory of the Carnegie Institution of Washington, D. C. After a daring descent into the steaming crater of Mount Katmai on the Alaskan peninsula, he has returned to Washington with valuable new scientific data on volcanic phenomena. He is shown above examining specimens of rock crystals found in the crater.

PROF. EDOUARD BRANLY, noted French scientist, who, by his invention of the coherer, made possible the experiments of Marconi and the realization of telegraphy without a connecting cable, recently received recognition from the French government by being made a Chevalier of the Legion of Honor. Professor Branly is 80 years old, yet he still works in his laboratory in Paris where he made his important discoveries. Above is a recent portrait.

DR. DANIEL W. MOREHOUSE, acting president of Drake University, Iowa, and a leader in astronomical research in America, announced a short while ago that he had discovered a new nebulous star, remarkable for the phenomenal amount of star dust particles of matter falling through space—that surrounds it. His observations have been verified by Dr. Harlow Shapley, noted astronomer, director of the Harvard University Observatory.



Huge Floating Elevators Load Grain Ships

THESE floating elevators, also known as grain elevators, are used to load grain into ships at tidewater terminals.

They are said to effect enormous economies over the old methods. In the floating elevators the grain is loaded into ships by gravity.

Mechanical Stump Puller Anchors Itself

A STUMP puller that carries an anchor and an extra weight, and therefore does not have to be anchored to tree or stump, is a new invention for reclamation of waste land.

The machine is a heavy axle mounted through the two rear wheels and supports the frame, in which the motor and pump are mounted. The pump is connected to the anchor blade to plow into the ground while

the machine is pulling at the stump. Additional anchoring weight is hung from a boom held by guy wires from the frame.



How the powerful machine anchors itself while pulling a stump

Seaplane Carried on Deck of Submarine

ON THE deck of the United States submarine MS-1 are hanging cranes for a seaplane. The hangar is a tank-like room into which the plane is stowed after the wings and pontoons have been

dismounted from the fuselage. Within a very few minutes after the submarine has reached the surface, the plane can be re-assembled and launched over the side of the submarine.



The U. S. Navy submarine MS-1, showing seaplane ready to be launched from its deck

Motor Drives Blades of Horse-Drawn Mower

A MOTORIZED mowing machine, invented by C. Chattin of Montreal, Canada, is drawn by horses, while the mowing blades are driven by power. Power is furnished by an internal combustion engine, which is connected with the blades.

The machine is designed to perform the work of a horse-driven sickle or mowing machine in a more satisfactory manner.

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The mower with power plant

New Vise Grips Irregular Object like a Hand

A VISE that grips irregularly shaped objects with the adaptability of a human hand is an important recent mechanical development.

The vise jaws, individually pivoting semi-circular jaws, are said to adjust themselves to the contour of an irregular object without the need of holding it absolutely rigid.

This even distribution of gripping pressure is designed to eliminate the danger of distortion when holding thin-walled objects, as automobile cylinders, or long and narrow work. The vise is tightened by pressure exerted on the vise handle.



The jaws gripping an irregular piece

Another important feature is that the jaws, once fitted to a shape, can be tightened with screws to maintain the same relative positions. Thus, in machining a quantity of objects of the same shape and size, the vise will serve as a special fixture, holding each piece in the same position as every other piece.

A LUNAR rainbow in the form of a complete arc was observed recently during a shower at Sanderstead, Surrey, England. The moon was shining in a portion of the sky that was for the moment cloudless.

Villages Wrecked to Build 16,000-Acre Reservoir

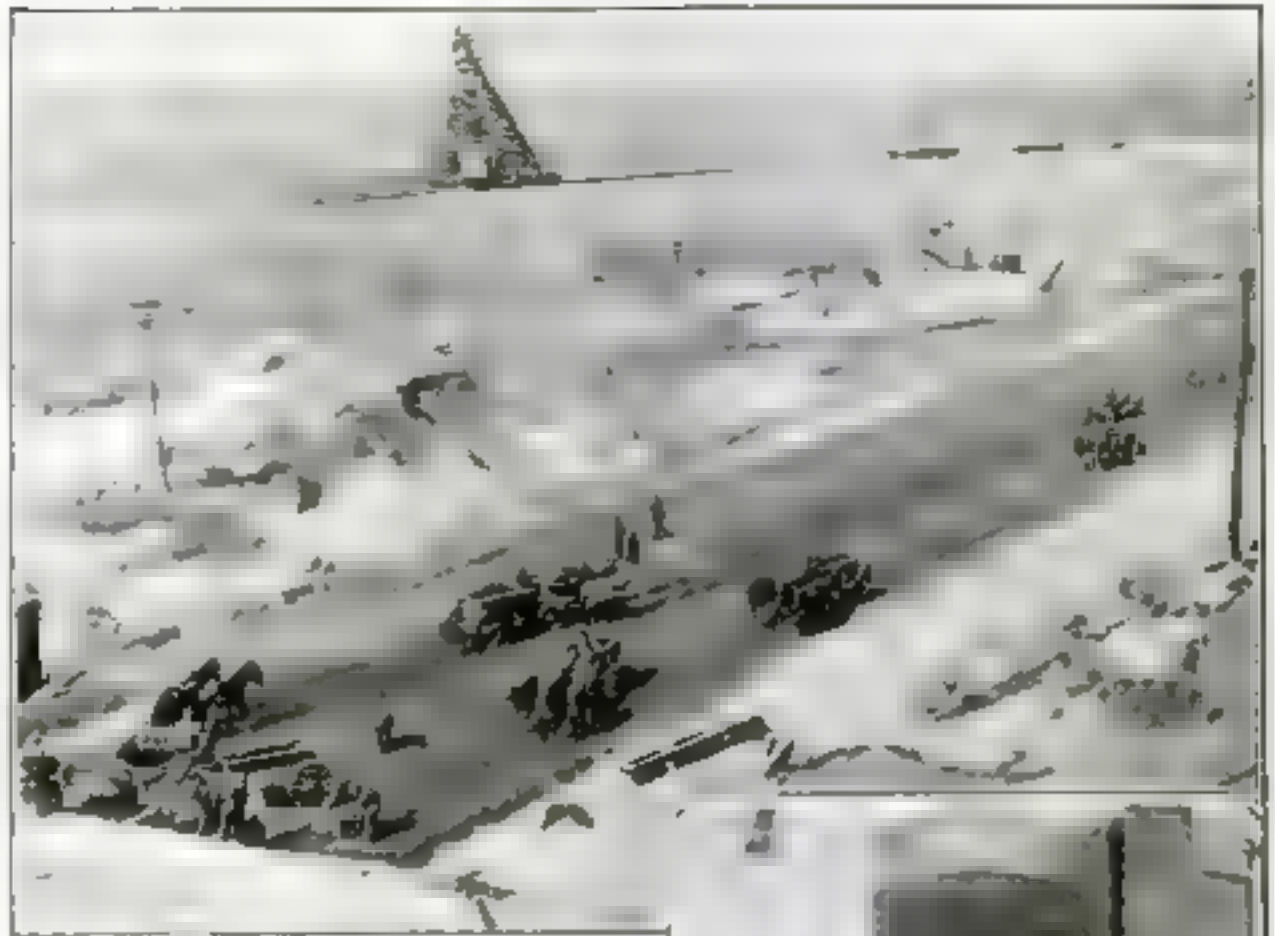
SIXTEEN thousand acres in the Pawtuxet River valley, R. I., are being stripped of villages, factories, roads, churches, schools, and cemeteries so that the city of Providence may have a \$6,900,000,000-gallon reservoir.

For eight years a hundred of workmen have labored to transform this wide landscape. Steam shovels have bitten away at huge hills. Great mushrooms of sand and rock have been hurled high into the air, and trainloads of sand and rock have wound in and out among the hills. Yet three more years will be required to complete the vast project.

A Thousand Buildings Demolished

Most of the 1195 buildings condemned already have been torn down. Of these, 375 were dwellings, seven schools, six churches, and six mills. Thirty-five miles of highways will have to be relocated. The remains in the 173 burying grounds are to be reinterred elsewhere.

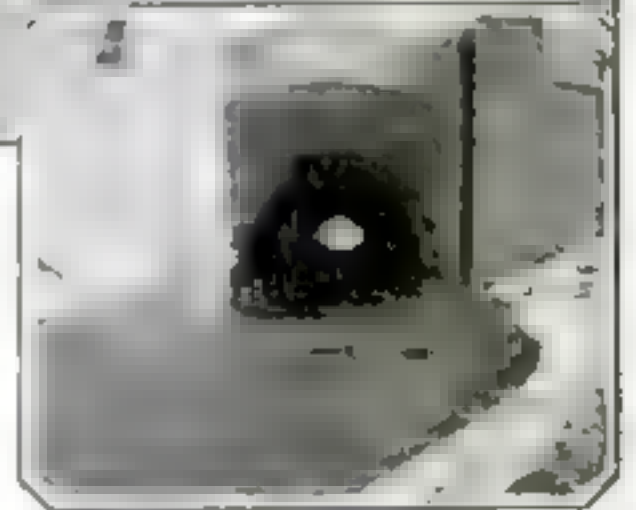
The site of this monster reservoir is at Scituate, about 10 miles from Providence, at a point where the valley of the Pawtuxet River huddles between towering hills. By digging away the lower hills in the basin and allowing the high hills to serve as the shoreline, the engineers can build a dam and have an enormous basin. This main dam stretches 3200 feet from one side of the valley to the other. In some places its foundation is carried 80



Digging to rock bottom for a solid foundation for one section of the main dam.

feet down into solid rock. Across its top will run a wide boulevard. The dam will be 8 feet thick at the flowline and will have a 4-foot spillway. At its base it will be 640 feet thick.

At a cost of \$280,000, the river's course was altered to facilitate the construction. One contract alone—that for constructing the main dam—amounted to \$3,500,000.



How the Pawtuxet River is diverted through a tunnel under the site of the dam.

Testing the Balance of Revolving Machinery

A BALANCING machine, designed for correcting the dynamic balance of machine parts in manufacture, thereby eliminating vibration in the assembled product, has been placed on the market by a Washington company.

The piece of machinery to be tested is placed in rollers in the carriage and fastened to the headstock. This headstock and the flywheel to which it is attached are turned by an electric motor. Centrifugal force tends to pull any unbalanced

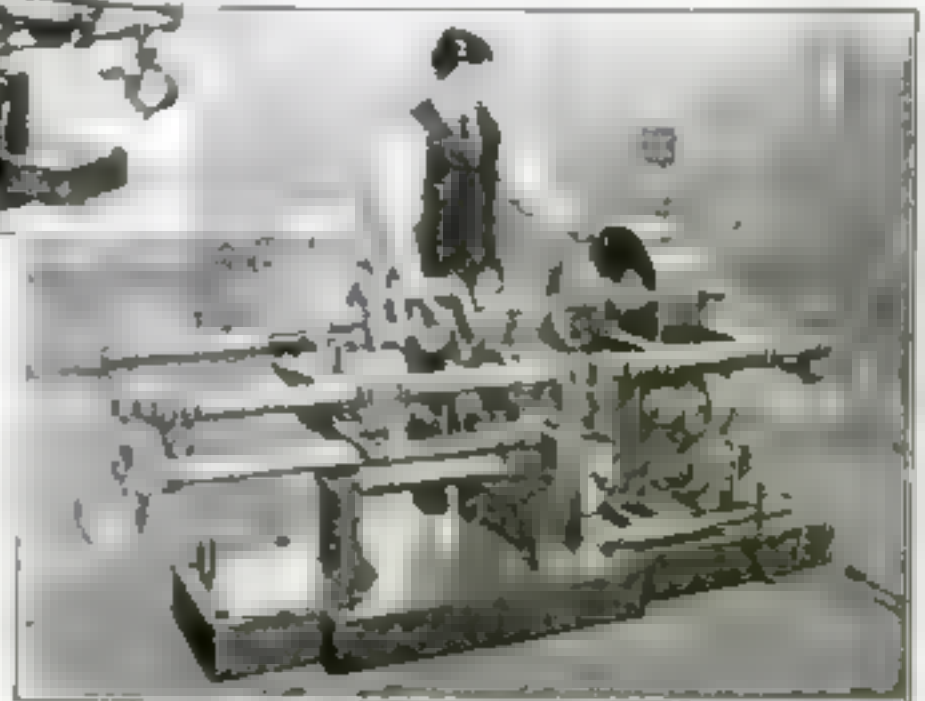
masses away from the axis of rotation, causing the piece of machinery under test to wobble back and forth as it is turned. These vibrations are transmitted to a recorder by means of a string. When there are no vibrations, the piece of machinery is perfectly balanced.

In addition, the amount of unbalance and the location of the heavy parts are determined mathematically by two tests of rotation, the necessary correction being recorded on a dial and vernier. The machine is adapted to a wide variety of work, including balancing crankshafts, flywheels, rotors, pulleys, and other revolving parts. It will receive bodies up to 24 inches in swing and 12 inches between bearings.



Above: The balancing machine showing how a piece of machinery under test is mounted on rollers in the carriage and fastened to the headstock. The flywheel and the electric motor are shown. A string is attached to the carriage and a recorder by means of a string.

At the right: Testing the balance of a crank shaft while in motion.



New Automatic Steadyrest for Machine Work

A NEW automatic steadyrest that will hold a piece of material steady to permit a machinist to perform such operations as boring, facing, and turning at the end of the piece, has been developed quite recently by a well-known Pennsylvania manufacturer.

The work is inserted from the top, and when the jaws are closed, is held by three rollers that revolve toward the center. When the work is in place, the handle end of the adjusting screw is dropped into a slot and the jaws are tightened by turning the screw.

The device may be attached easily to the lathe or removed. It is claimed. When once adjusted for the required purpose, no further alteration is necessary until a new job is handled.

Stock of many sizes may be handled with no adjustment of the apparatus besides a few turns of the tightening screw.



Locomotive Turned into Pumping Station

WHEN the air pump in the power house of an iron-ore mine failed, the mine was in a serious predicament. The pump was the only one of its kind in the mine, and it was essential for several reasons, and it was pumping fuel for the men and work. One of the engineers mastered the situation, and the serious cost of such a

shut-down was spared the shop and the mine.

The air pump of 24 locomotives were harnessed to the sides of a coal gondola and supplied with power by a large freight engine. Within less than 24 hours from the blowing of the piston head, full pumping efficiency had been restored.

Trousers Pressed Quickly by Electric Valet

AN ELECTRIC valet, when attached to an electric light socket, is claimed to press a pair of trousers in the time it takes a man to shave, is one of the latest of home electric appliances.

It consists of three flat units: a top, a heating pad, and a pressing pad. The pad is equipped with a thermostat that shuts off the current when the correct temperature has been reached, thus preventing overheating and scorching.



To press the trousers, the heating pad is dampened evenly on both sides with a moist rag. Then one leg of the trousers is spread out, smoothed and stretched on the base so that the cuffs extend over the edge. The pad then is placed over the leg and the second leg is placed on the pad. Over all the top is laid and fastened by clamps. Finally, the current is turned on.

It is claimed that only 12 minutes are required to press light summer trousers, and from 15 to 20 minutes for heavier trousers. The cost of one pressing is said to be about two cents.

Simple Door Guard Locks Key to the Knob

THE inventor of a simple door guard

that no burglar can push in the key of a door equipped with the device, and insert his own. One end of the guard encircles the neck of the door knob and the other end passes through the eye of the key. The key then cannot be turned nor pushed out by an unwelcome intruder.

The guard is made in two models—one that can be opened and detached, the other permanently closed, requiring removal of the knob to detach the guard.

TO TELL whether fabric contains sizing to improve its appearance, boil a piece of the goods. This brings out the sizing.



How the key is locked to the door knob

Cigar Cutter and Knife from Old Razor Blades

OLD razor blades may be put to a dozen uses, it is said, by means of this handy pocket contrivance, designed to fit any make of blade. It folds like a jackknife, and is flat and thin, and therefore fits in the pocket without sagging or bulging it.

Besides serving as a pocket knife, it has a round opening, placed so that when the knife is closed, the blade serves as a cigar cutter. Another opening is provided for cutting string on packages—often dangerous with an open blade.

A notch in the handle can be used as a handy bottle opener, while a pointed corrugated lever on the blade-holder serves as a nail file or match striker when the device is closed. Extending this lever supplies the user with a nail cleaner and a piercer.



Safety razor device used as cigar cutter

Hole in License Plate to Foil Thieves

AN AUTOMOBILE license plate with a large square cut out would be almost certain to attract the attention of a policeman immediately. On this fact Jons Nelson, of Los Angeles, Calif., based his invention of a new anti-theft device.

An auto driver, when leaving his car,

detaches a rectangular section cut from the center of the plate, as shown below. When he returns, he inserts the missing piece. Both operations are simple and quickly accomplished. An electric alarm reminds the driver if he forgets to put back the missing portion.



The theft signal plate with section removed



License plate with cut-out section replaced

Five-Ton Tractor Tows 160-Ton Railway Mail Car



A FIVE-TON endless tread tractor couched a 160-ton mail car over 400 feet of temporary track from the main line of the Chicago & Alton Railway recently.

at an Illinois fair. The tractor towed the car to the main line for repairs to a damaged axle. A small engine was used to start the tractor.

rear of the car and the powerful tractor tugged alongside, pulling the heavy car like a tugboat towing an ocean liner into its waiting dock.

Would Dye Motor Gasoline Red for Safety

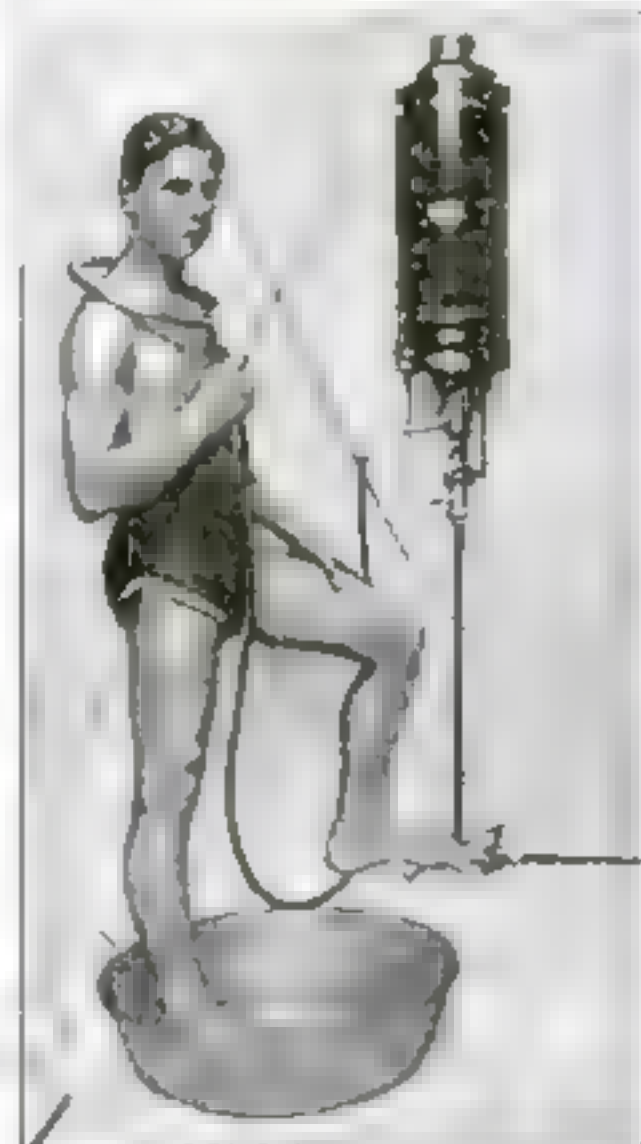
FOLLOWING a study of the hazards of gasoline, the United States Bureau of Mines has suggested that all motor gasoline should be colored red as a safety measure against mistaking it for water, kerosene, or other colorless liquids.

The Bureau has found that one ounce of dye is sufficient to color 1000 gallons of gasoline.

Midget Vacuum Cleaner Is Clothes Brush

A THREE-POUND vacuum cleaner that can be operated by one hand, has been invented for removing dust, lint, and raveling from clothes, hangings, automobile interiors, upholstered furniture, and similar surfaces inaccessible to the usual vacuum cleaner. A stiff brush attachment is provided for cleaning billiard tables, walls, and other solid, flat surfaces.

The device collects dirt and is emptied like the usual cleaner. It is said to exert ample suction for any of the purposes enumerated.



Simple Home Shower Bath Is Easily Installed

A HOME shower bath, usually considered a luxury, is said to have been made available at a cost far below that of built-in fixtures by a newly invented apparatus designed for use with a small gas water heater.

A foot control regulates the gas flow and hence the water temperature. Another model of the same device attaches to the faucet of a bathtub where one faucet discharges both hot and cold water.

Perforations in the lower half of the shower ring produce scores of tiny streams. There is a steady, generous flow over the whole body, yet the hands of the bather are left free. The hair cannot be wet, as under the ordinary shower.

Cigarette Lighter Uses Spark and Benzine

BENZINE and an electric spark are substituted for matches in this cigarette lighter. The tipped cylinder shown in the righthand holds a wick and benzine. When a light is desired, the tip is touched to two metal strips which beneath the flange. A spark from a battery within the device lights the tip and the wick at the tip of the cylinder.



Fume Masks for Painters

RESPIRATORS and rubber gloves are being adopted in England to protect painters from lead poisoning and other ills to which they are otherwise exposed in working with paints and varnishes.



Protected by mask and rubber gloves



Vacuum cleaner used as clothes brush

Lantern Light Is Bait for Fishes

ON CALM nights along the shores of the Mediterranean, fishermen often may be seen using the light from lanterns to attract the fishes. Remaining in a shadow, they wait until the fishes come close enough to the boat to be harpooned with tridents.

Adopting the same principle, two French naturalists, M. Fage and Legendre, have devised an ingenious lantern to assist them in their zoologic researches by projecting light into the

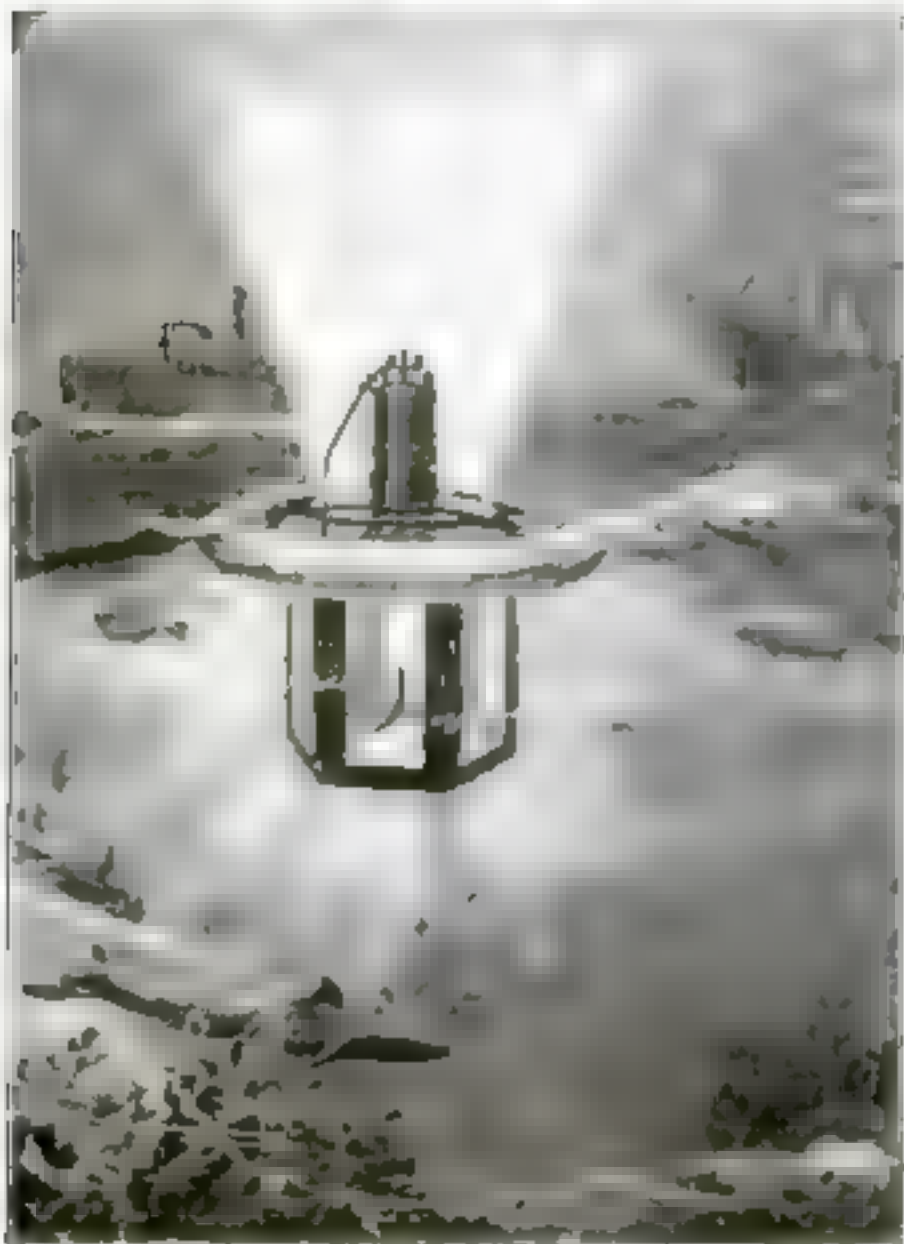
water. It is designed to attract the millions of small fish and marine animals that infest the waters of certain regions, to illumine them so that they may be observed and studied in their native haunts. It works the same as the old-fashioned lantern but, of course, is more efficient.

The lamp consists of a six-sided box with six windows. This box is about 18 inches high and is suspended from a circular float 27 $\frac{1}{4}$ inches in diameter. On top of the lantern is mounted an acetylene gas generator, from which the gas is conducted to a burner tip near the bottom of the box.

Two boats holding a net between them can surround the space in which the lantern floats and capture all the fishes, large and small, that have been attracted by the light. It is possible also to float the lantern near the shore and attract the fishes that remain near the beaches. In this way a dragnet can be used to haul the fish ashore.

The use of acetylene is especially advantageous because water is the element that produces the gas. Thus, even if the generator is completely submerged, it will cause no harm. Instead of using a cork buoy the float may be built of metal, making the air chamber watertight.

The apparatus, it is said, can be used for both scientific and commercial purposes.



Light from the floating lantern attracts the fishes



Speeding Machinery Made to Appear Motionless

MACHINERY speeding at many thousand revolutions a minute, can be made to seem motionless or to appear to be moving at any desired speed. It is claimed, by a new electrical observation instrument called the rotostat. High speeds are thus made to yield to mechanical analysis.

The device is connected with a light socket and two knobs are turned until the machinery under observation appears stationary or moving at the speed desired by the observer. A lamp and reflector are mounted on an adjustable standard with the machine.

Errors in timing of interlocking parts, unexpected interference, deformation of parts under centrifugal stresses, and speed variations are said to be revealed clearly by the instrument.

The photograph above shows an observer studying the operation of a magnet wire insulating machine that is applying a double cover of silk to copper wire at a speed of 4000 r.p.m. He sees each wrap of silk as it is wound on the wire.

How to Photograph Panorama with Ordinary Camera

MOST amateur photographers will be surprised to learn that excellent panoramas can be photographed with an ordinary camera. The remarkable fine picture below is striking evidence that the feat is possible.

It was taken from the top of a 125-foot tower with a 3 $\frac{1}{4}$ by 8 $\frac{1}{4}$ folding camera and included approximately one quarter of a mile of lateral distance. Note how perfectly sky line, coast, and buildings match, attesting the astonishing accuracy of the method.

To take similar pictures you need, besides the camera, only a stationary tripod or some other object upon which the camera is mounted solidly while being permitted to swing from side to side. The equatorial telescopic tripod is ideal for the purpose, since the thumbcrew may be loosened, allowing circular motion while still holding the camera firmly.

When the camera is in position, take an exposure of one extremity of the panorama desired. Now swing the camera, not the tripod, toward the center of the

panorama, allowing a tiny strip of the previous view to show in the view finder. Change the plate or film and make another exposure.

Succeeding sections of the panorama are made similarly.

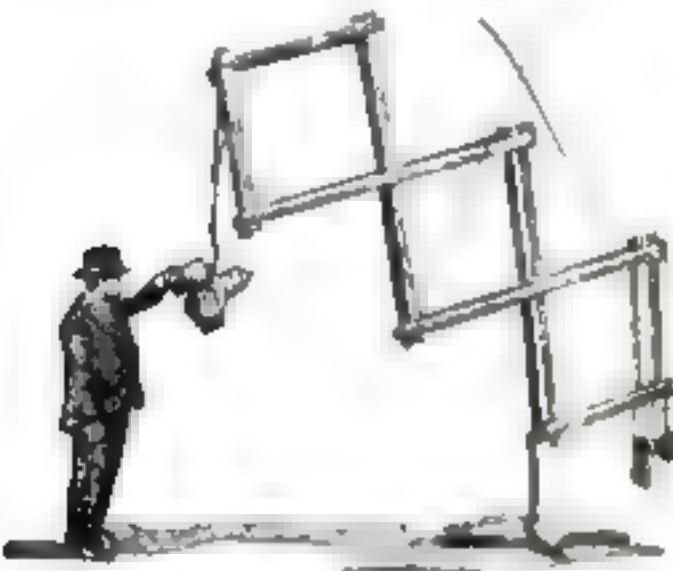
The films may be cut and matched when dry or separate prints can be made. For ordinary pictures, the regular stop and snapshot one fiftieth of a second exposure is sufficient. In views like the one below, it is best to use the smallest stop and short time exposure.



Lake Invents "Lazy Tongs" to Hold Heavy Tools

TO AID workmen in lifting and carrying heavy tools and other objects, Simon Lake, noted inventor of submarines, has devised what is called a "gravity eliminator." It is a lever actually pivoted on a pivot so that, when the long end always will be twice the length of the short end.

From the short end is hung a weight sufficient to balance a cement gun, riveting hammer, air or rock drill, or whatever



Simon Lake, famous inventor of submarines, demonstrating his "gravity eliminator."

heavy tool may be attached to the long end. The effect is that a tool that actually weighs 50 or 60 pounds seems to float in the air, relieving the workman of the muscular effort of supporting it.

The extensibility of the device and the fact that it swings on a pivot give the workman a wide latitude of movement, says the inventor.

Garage Doors Opened by Weight of Auto

AUTOMATIC garage doors recently perfected, are opened by the weight of a car as it approaches on a runway. After the car has entered, the weights close the doors. The doors close when the car is on the runway or threshold, the inventor claims. Any sized garage can be equipped with the invention, it is said.



Weight of car on runway opens doors.



Moving Walks Designed to Solve Traffic Problem

A UNIQUE three-speed moving walk soon may replace the subway turntable trains that make the thronging run between Times Square and Grand Central Station, in New York City. The pictures show a model being tested in a field at Jersey City, N. J.

The "walk" will consist of three parallel platforms running at three, six, and nine miles an hour respectively. It will run in a continuous loop. Passengers step from a stationary platform at each terminal upon the three-mile-an-hour platform, from this to the six-mile platform and thence to the last, upon which are seats. An electromagnetic power plant operates the carrier.



Above is a section of the model moving walk showing the electromagnetic drive.

Compressed Air Drives Midget Power Shovel

A COMPRESSED-AIR power shovel, only 5½ feet long and operating on an 18-inch track, could rapidly be used to work in cramped quarters, such as tunnel digging.

The shovel superstructure is carried upon a specially designed ball bearing. The swinging engine is vertically mounted and swings the shovel through a complete circle. No clutches are used, the engine being reversible while running at full speed and controlled by operating levers.



Compressed-air shovel operating in tunnel.

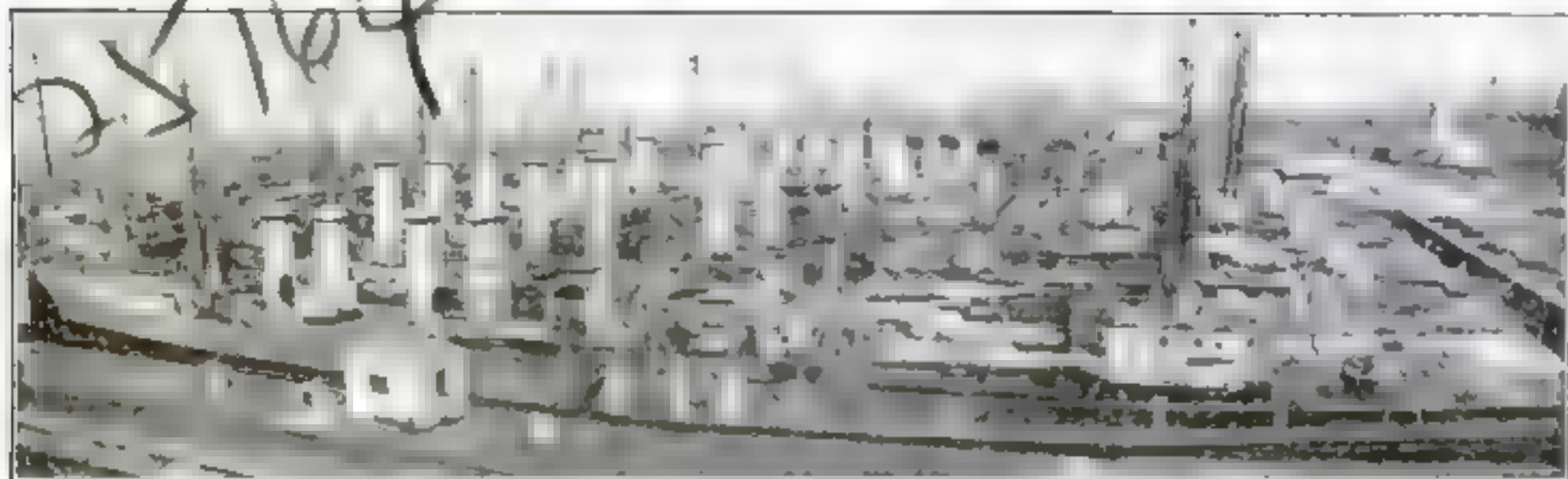
Realistic Ocean Breezes from Vacuum Cleaner

OCEAN breezes, or a most deceptive imitation, can be obtained by using a vacuum cleaner. The effect of sea cliff breezes is heightened by placing the converted vacuum cleaner in an open window.

The bag and driving belt of the cleaner are removed and a sponge soaked in salt water is placed in the suction end. The effect of sea cliff breezes is heightened by placing the converted vacuum cleaner in an open window.

A NEW preparation to prevent clouding of auto windshields, perfected by the Navy Department, consists of a sodium salt of sulfonated rapeseed oil, with an excess of caustic soda and a small amount of waterglass, glycerin, and engine oil.

Where Acres of U. S. Destroyers Rust in Navy Yard



THIS remarkable view of the League Island Navy Yard, Philadelphia, Pa., shows how more than 100 destroyers, built by Uncle Sam at a cost of about a

million dollars each, lie huddled along the docks like sardines, gnawed by the elements.

Rusting beside them is a row of nine

battleships, a number of Eagle boats and other wartime auxiliary craft. The government has advertised many of them for sale. These not so well-kept vessels



Taking Dictation through Office Loudspeaker

TAKING dictation from a loudspeaker is one of the new experiments of the stenographer in a modern office. The business man who is dictating the letter sits in his chair in the lower part of the building and speaks into a telephone transmitter. The loudspeaker carries his words clearly to the stenographer, who transcribes them in a method that saves time all around.

Builds Novel Diving Suit from Old Boiler

IMPROVISING a diving apparatus from an old household hot-water boiler, 15 yards of rubber tubing, a length of heavy rope and a discarded beer pump, Walter Merwin, of Perth Amboy, N. J., has become a successful commercial diver.

He is the submarine member of a firm that salvages metal junk from vessels about to be scrapped. The inventor claims he can make deep dives with this rough-and-ready "suit," and that his homemade outfit is safe enough for him.

Walter Merwin and his homemade diving helmet made from an old boiler



At the left Merwin is shown submerging for salvaging operations, using his odd homemade diving apparatus. He is the beer pump used to supply air to be breathed down through 15 yards of rubber tubing. Note also the window cut in the side of the old boiler



New Piano Keyboard to Simplify Fingering

THE keyboard of the modern piano is an unaltered heritage from the instrument of several centuries ago. Novices and virtuosos alike have been aware of its limitations for fingering, but seem always to have reconciled themselves to it.

Now, at last, the graining, athletic fingers can relax, according to Dr. Moris Stoeck, professor of bacteriology at Mt. St. Vincent College, New York. He has invented a scientific keyboard, with which, he claims, novices may save many of the weary hours of finger exercises. He also claims that pianists may create tonal beauties heretofore impossible.

The only visible difference between the new keyboard and the conventional one is the shorter length of the black keys. These do not extend all the way back to the fallboard, as in other keyboards, and the white keys widen to full width again behind them. This makes available a second row of white keys.

The new keyboard can be installed in a standard piano in a day, without structural changes in the instrument, the inventor asserts.

Radio Tubes for Autos

THE automobile engineer has added the vacuum tube, the miracle worker of radio, to motor-car equipment.

With vacuum tubes to control the ignition, the timing of the spark and its duration is said to be controlled accurately without the usual complicated adjustments necessary with present types of generators and interrupters, and without constant adjustment to counteract the effects of wear and tear on interrupter contacts and mechanism.





This Milk-Can Cover Is Operated by Pedal

AN INVENTIVE Indian farmer has devised an effective apparatus to keep the milk in his can free from the dust and insects that invariably invade even the most sanitary dairy barns.

It consists of a lead cloth-covered lid of wood that rests on top of the strainer above the can while the milking is in progress. To pour his pail of milk into the can, the milker simply steps on a pedal, indicated by the arrow, which swings the lid upward and backward.

Handy Reamer Cuts "Cake" from the Old Pipe



DEAR SMOKE is a by-product of the rooted conviction of thousands of smokers, taints rather than improves the taste of tobacco smoke, this sugarlike cleaner cuts and forces out the charred accumulation. The reamer is inserted in the pipe bowl and slowly turned, scraping out the cake easily.

Most pipes are boiled in oil before they are finished, to prevent to some extent the formation of cake.

Iowa Boy Drives Midget Electric Auto

NEARLY every small boy has dreamed of owning a real automobile—one that really runs by itself. For the six-year-old son of Ralph Frick, of Burlington, Ia., this dream has come true. His father has built him a midget electric car that makes 12 miles an hour on the level, has automatic brakes, disk wheels, and a self-starter, and weighs 70 pounds.

At a state fair this play auto pulled a 2½-ton brougham several hundred feet in front of the racetrack stands. Yet, for all its power, and its detailed resemblance to full-sized models, the car embodies safety in a remarkable degree.

Electric power is generated from a four-cell battery under the hood, which runs the car 20 miles without need of recharging. Under the seat and connected with the rear axle is a self-starter. An electric spring shut-off accelerator adjusts the power and speed, and a reverse switch changes the direction of the current for backing. Automatic



This Iowa boy drives his own electric

brakes and an emergency brake are provided.

To start, the child places his foot on the self-starter button, transmitting power to the driving apparatus on the rear axle. When the foot is removed, the power instantly is shut off and the automatic brakes are applied. The back wheels immediately lock, so that even on a hill the car stops.



Horse Dines in Comfort from New Nose Bag

INVENTIVE ability and a love of horses combined to perfect this feed bag. The old type of bag made simultaneous eating and breathing painful and sometimes barely possible for a horse. Moreover, in the struggle, the hungry animal often lost an exasperatingly large portion of his oats. The new bag has a reservoir on each side, from which the feed drops into the nose portion as this container is emptied. The roominess of the bag permits the entry of plenty of air for the horse to breathe.

The Women's League for Animals is responsible for the perfection of the bag and is urging its universal use.

GOVERNMENT hunters now use catnip to lure bobcats and mountain lions into traps.

Disk Plow Designed to Break Hard Ground

A POSSIBLE solution of the plowing problem on hard ground is seen in the invention at San José, Calif., of a disk much pulverizer. The part of the machine that cuts into the ground consists of a set of disks, each of which is of cast-steel. Breaker cutters from three-quarters to 1 1/2 inches in diameter are attached to each of the disks.

The disks turn at a speed of the plow's speed, and revolve 250 times a minute. They cut into the ground from two to 12 inches, and are raised or lowered according to the depth of cut desired. The disks may be from 16 to 24 inches in diameter.

The pulverizer is driven by a 1½

horsepower gasoline engine mounted on a frame above the disks. It is drawn ordinarily by a horse, but with a universal joint attachment, a tractor may be made to serve the purpose.

Belts and a counter-shaft transmit power from the engine to the disks.



Power-driven pulverizer, showing disks that cut into hard ground



© Kaymont

Radio Watch Sets Itself by Time Signals

A RADIO watch apparatus that automatically sets the hands each noon when radio time signals are broadcast, has been invented by Lt. John Iseman, of the United States Navy, shown above.

The outfit consists of a miniature radio receiving set with a fixed wave length of 455 meters, a fixed cartridge detector, and a "self-restoring coherer" that closes the circuit between a small storage battery in the watch and a sensitive relay ingeniously built into the watch.

The snap mechanism wheel has as many teeth as the number of dots that are transmitted during the five-minute period in which time signals are broadcast. This wheel is rotated, one tooth for each signal sent, until the snap mechanism for setting the hands—as in a stopwatch—is released and the hands snap to noon.

A tiny aerial, 30 feet of gold-plated wire, is within the case of the set.

Crystal Set Is an Ashtray

A BUSY radio fan, whose desk was too crowded to give room for both an ash holder and a receiving set conquered the problem by combining the two.

This little instrument has a crystal detector and a specially wound coil, atop of which rises the ash receiver. The unit is connected with a light socket, the other end of an aerial.



Listening in with the ashtray receiver

New York Police Operate a Broadcasting Station

RIVALING the most powerful and elaborate broadcasting stations in the United States, New York City police headquarters station is a powerful ally of the law.

Broadcast descriptions of criminals and missing persons, it is believed, will place hundreds of thousands of persons on the alert as posters and handbills never could. Following fires, wrecks, or other severe disasters, the station will broadcast the names of all casualties, thus avoiding a flood of calls to the police from anxious friends and relatives.

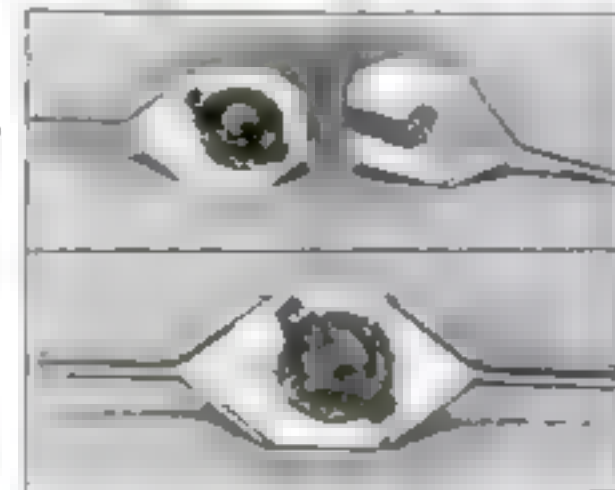
When not in use for such purposes or serving in interdepartment communication, the station will broadcast concerts by the Police Department band, lectures bearing on matters of civic interest, and other programs.



Broadcasting station in police headquarters

Simple Clamp Takes Place of Lightning Switch

ALTHOUGH the use of a lightning switch is recommended by the National Bureau of Standards, a simple clamp can be substituted across the end of an aerial wire of a



The wingnut makes a strong connection

radio outfit, many radio owners choose to take the extra precaution of connecting in a lightning switch so that they may be certain of a positive connection between the aerial and the ground.

A simply constructed clamp that meets this need while obviating the standard lightning switch, is shown in the illustration above. Connection is made by slipping the slotted member into the projecting screw of the other member and tightening down with the wingnut. The bayonet joint makes a strong connection.



Eiffel Tower Model Holds Powerful Receiver

THIS model of a famous Paris landmark holds a powerful receiver of the three-circuit regenerative type. The receiver has two stages of audio amplification, permitting the use of a loudspeaking horn.

Lubricating Switchpoints

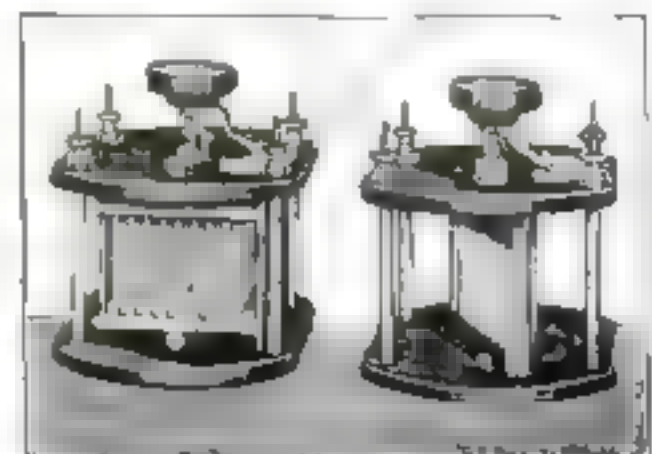
A LITTLE vaseline rubbed lightly on the switchpoints of the radio receiver will make the arm slide easily over the points and obviate any chance of friction wearing down the points.

New Variable Condenser

THE latest wrinkle in variable condenser construction comes from France. Every radio fan is familiar with the standard type of variable condenser in which the change of capacity is accomplished by varying the amount of surface presented to one set of plates by another.

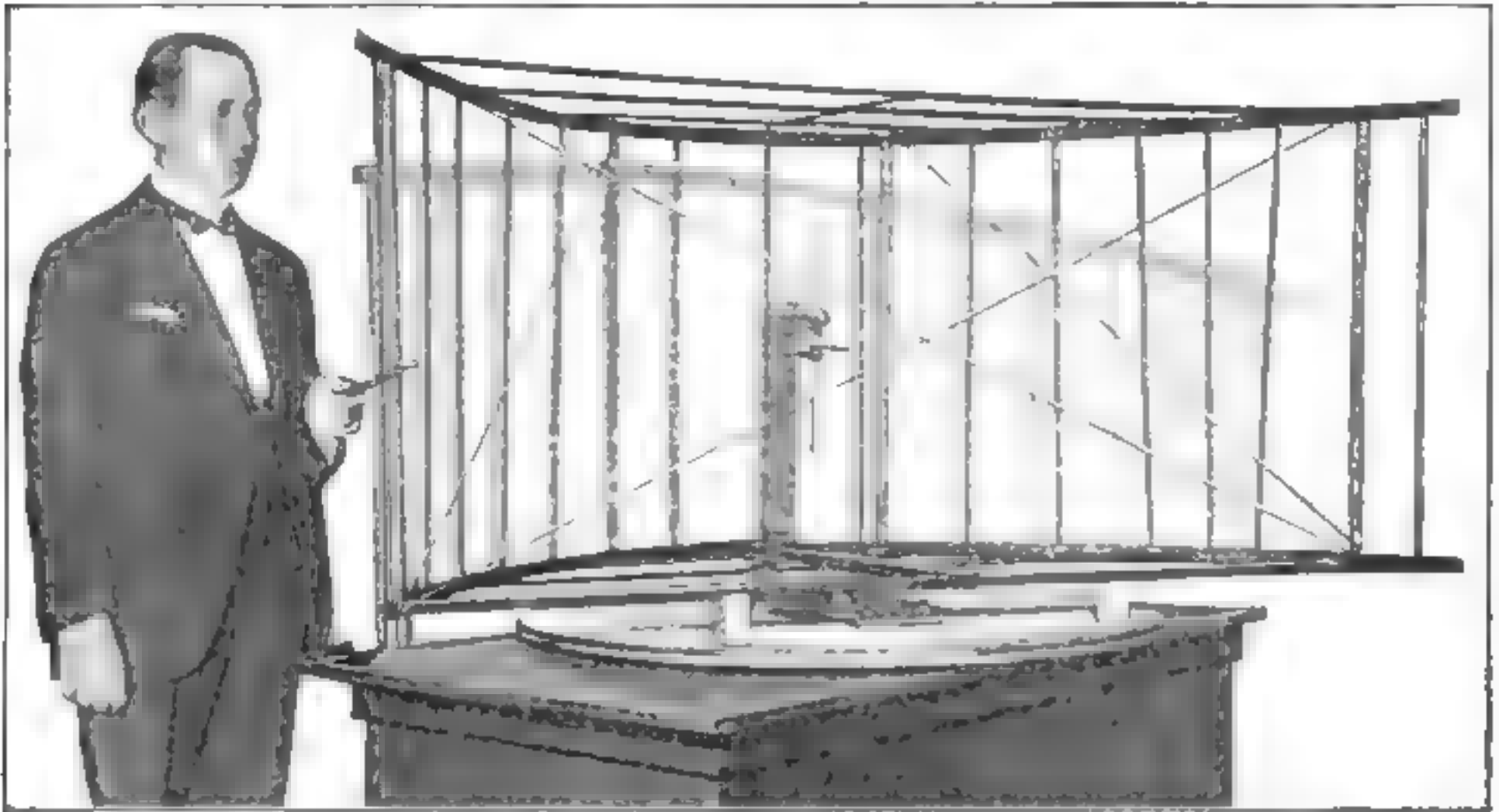
In the new type of condenser the principle that the capacity of a condenser can be changed by varying the distances between two sets of plates is utilized.

Rectangular plates are so mounted between four horizontal supports that when the central knob, connected with these supports by a linkage system, is turned, the distances between the two sets of plates is varied, thereby changing the capacity of the instrument.



Turning knob varies distance between plates

Secrecy in Directed Radio



Senator Guglielmo Marconi, discoverer of wireless transmission, and his "radio searchlight" an antenna reflector with which he has succeeded in throwing a powerful beam of radio waves in any given direction, in the same manner that a mirror reflects a beam of light

By Jack Binns

America's Most Popular Writer
on Radio

A FEW weeks ago Signor Marconi announced that radiotelephone communication had been established between England and the Canary Islands—over a distance of about 2000 miles. While on the face of it there was nothing extraordinary in this statement, it encompassed an achievement of tremendous importance in world communication; for the long-distance messages were directed to a specified point under conditions that practically insured secrecy from all radio receivers except the one for which the messages were intended.

The "Radio Searchlight"

The success of this long-distance test was the result of Marconi's continued experiments with the "radio searchlight," by means of which he focuses radio waves in a powerful beam in a definite direction. Direction of the waves is accomplished by means of an antenna reflector that throws a beam of radio waves in much the same manner that a hand mirror throws a beam of light waves.

In conjunction with other experiments along similar lines, Marconi's announcement would seem to indicate that commercially practical application of secret radio is not far distant.

Recent experiments to achieve complete secrecy have followed three distinct lines, as follows:

1. Reflected waves of tremendously high frequency, directed as a radio beam toward a specified point.

2. Obtaining secrecy by means of suppressing the carrier wave and one of the side bands.

3. Deliberate "scrambling" of speech in transmission so that only a receiver specially designed to translate it can understand the message.

The first type of experiment is being followed by Marconi and British experimenters associated with him, while the second and third types are being pursued by American experimenters. By a strange coincidence, the first two offer the advantage of requiring less power than is normally necessary to cover a specified distance.

The success of Signor Marconi's reflection method depends upon a principle made practical by the development of the vacuum tube and the super-heterodyne receiver. There is a certain romance about this system, for it was the very first employed by Marconi in the late '90's when he startled the world by communicating between two points without the aid of connecting wires.

Almost Missed Broadcasting Marvels

Experiments previous to his own had determined the fact that reflection of electromagnetic waves was just as feasible as the reflection of light waves. With this in mind, Marconi set about to develop such reflectors, employing them at the transmitting and receiving ends of his apparatus. By doing so, he almost missed the wonderful possibilities that radio opened by its very ability to broadcast in every direction, without which communication between ships would have been utterly impossible. But the crude appa-

ratus in use in those early days precluded the development of reflected waves. As a result, Marconi turned his energy to perfect and extend ship communication.

Shortly before the war, however, Marconi again reverted to his first love, investigating its possibilities upon extremely short waves where the frequencies involved run above the 100,000,000 a second mark. At first he used spark transmitters, and achieved some slight success, but real results did not materialize until the oscillating vacuum-tube circuit was discovered.

Great Progress in Radio Reflection

Tremendous strides in the reflected-wave system of communication in the past two years have been made possible by the regenerative circuit and the super-heterodyne principle. The former is used in transmission and the latter in reception. The system of reflection, however, is Marconi's own, developed by him and his assistants, chief of whom is C. S. Frankin, a prominent British radio engineer.

Secrecy in reflected waves lies in the fact that the waves, instead of being broadcast in every direction, are concentrated in a single beam by suitable reflectors, then shot forward in a direct line between the transmitter and the receiving apparatus. Naturally such a beam is governed by the laws that govern reflected light beams—the farther it travels from the producing source, the more the beam broadens.

Only a receiver that is in the path of this reflected beam can intercept the message it carries. Even then, the

receiver must be especially designed to respond to such terrific frequencies.

Marconi's recent successes over vast distances with this system have been achieved by painstaking development of the antenna system used with the receiving apparatus. He found that if at the receiving end he used a radio mirror that was a replica of the one employed at the transmitting station, signal strength was increased materially and greater distances could be obtained.

Perhaps there is an analogy between the radio reflector and the gigantic reflector mirrors used in large astronomical observatories to pick up and concentrate the weak light-wave energy received from distant stars, which could not be seen by the unaided human eye. The ordinary radio receiver in this case could be likened to the unaided eye, while Marconi's receiving apparatus would correspond to the giant reflectors.

A Second Method for Secrecy

In my opinion, the second system I have mentioned—that of obtaining secrecy by suppressing the carrier wave and one of the side bands—offers even greater possibilities with fewer drawbacks. Reception in this case can be obtained only with a receiver equipped to provide the missing frequency of the suppressed carrier wave by means of a local oscillator.

In addition, the system requires what might be termed less space in the ether, thereby making available a larger number of channels for communication. This is a particularly valuable consideration for commercial transatlantic communication. In such transmission only long waves are available; and since the frequency difference between any two of long waves is very small, the number of channels available is very small.

As an illustration, suppose we take a 5000-meter wave (the one that has been used in the actual experiments). Such a wave has a frequency of 60,000 cycles a second. A wave of 6000 meters has a frequency of 50,000 cycles a second. Thus, while there is a difference of 1000 meters between these two waves, the frequency difference is only 10,000 cycles. This means that if both of the carrier waves and their side bands were radiated at the same time, the lower side band of one wave would interfere with the upper side band of the other.

Prevents Interference

The system of suppressing the carrier wave and one side band would prevent such interference. In addition, there is the added advantage of secrecy obtained by the absence of the carrier and one of the side bands. Of course, absolute secrecy has not yet been attained by this method. It is possible to receive such signals on any oscillating regenerative



This diagram illustrates Marconi's system of directed radio. Instead of being broadcast in all directions, radio waves are concentrated by an antenna reflector (at the left), into a radio beam which is directed toward receiving antennas.

receiver, yet the speech so received is more or less distorted, assuring a certain measure of secrecy.

While experiments with the system have been restricted to transoceanic communication on fairly long waves, there is no reason why they should not be applied to telephone communication across land spaces with small power and on short waves, along the lines that govern amateur radiotelephone transmission. The transatlantic experiments have been con-

ARE you getting the most out of your radio receiver? Or is there some elusive imperfection that limits the range of your radio pleasure? Next month Jack Binks will reveal secrets of selecting and operating apparatus and circuits that will help you bring your set up to maximum efficiency.

ducted from the huge radio transmitting station at Rocky Point, L. I., where high-powered water-cooled vacuum-tube amplifiers are employed.

The transmitting apparatus consists of two modulators, two filters (which eliminate the carrier and one side band), and three amplifiers. After the filtration has been completed, the output is passed through the first amplifier with a power rating of 750 watts, then through the second, which has a power of 15 kilowatts, and finally through an amplifier

with a power of 150 kilowatts, which has been found sufficient to transmit signals across the Atlantic in daylight. An idea of the tremendous amount of this power can be obtained by considering that in the average first-class radio broadcasting station, only one half of a kilowatt is employed for radiation purposes.

In transatlantic tests during the past year, interesting data was obtained. From experience with transatlantic radiotelegraph work, it was expected that daylight reception would be more difficult than the night transmissions. This was verified by actual experience.

Tests were made every hour of the day for a period of 12 months, and a careful record made of the signal strength, as compared with the strength of interfering noises such as static. The results obtained were then plotted on curves, so that it was possible to get a clear idea of conditions.

New Facts about Reception

It was found generally that reception in the winter months in England was best just before daybreak. Strangely enough, it was found that in the summer months the best reception occurred a few hours after daybreak in England.

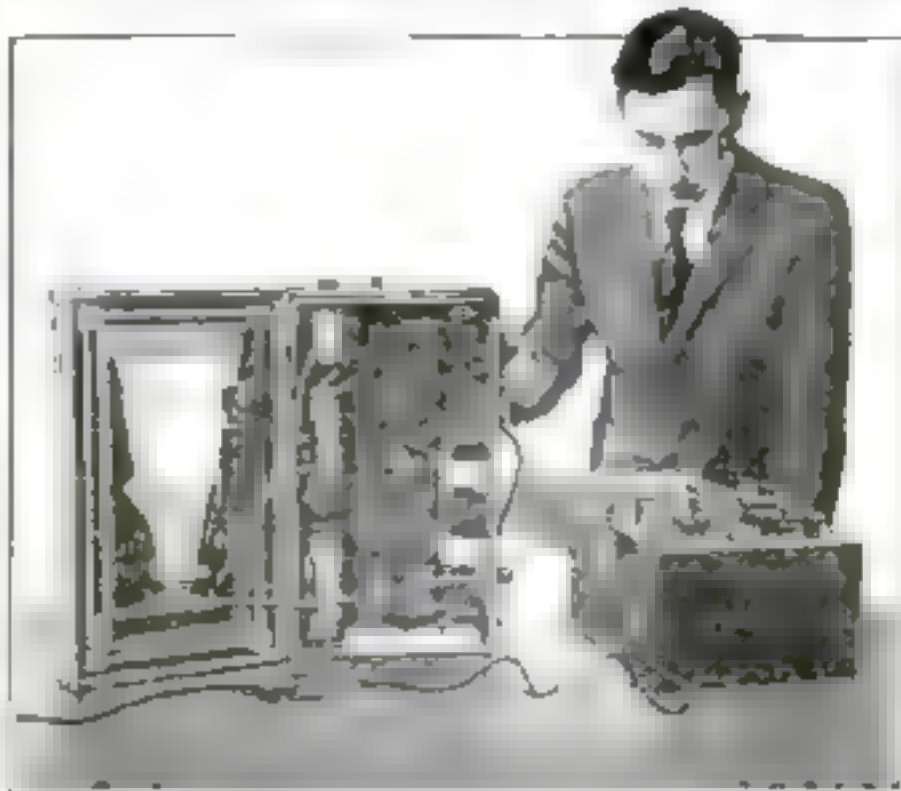
One of the interesting points brought out by the experiments is the fact that reception is neither very good nor very bad during the three hours when business is in full swing both in London and New York City. This occurs between the hours of nine o'clock in the morning and noon, New York time.

Reception is accomplished with a specially designed super-heterodyne receiver with which a local oscillator is connected for the purpose of supplying the frequency corresponding to that of the missing carrier wave. The key to the whole system is the missing frequency that must be produced locally in order to obtain satisfactory and undistorted reception.

"Scrambling" Messages

The third system mentioned at the beginning of this article is that of "scrambling" the message that is being transmitted. It is based on the idea of deliberately distorting speech in the modulating system before the voice currents are impressed on the transmitter. A receiving set designed to pick up the messages would respond to the distorted vocal frequencies, make the necessary allowances and reproduce perfectly understandable words.

Should this system prove successful eventually, it could be applied readily to either of the other two systems described. In fact, there is no reason why all three systems should not be merged—when they have completely passed out of the experimental stage—into one absolutely accurate system of secret communication.



One of the most noteworthy of recent contributions to the development of radio communication is an instrument that is said actually to record spoken words received by wireless. It is the invention of Francis Drumore, of Washington, D. C., who is shown above with his creation, known as a radio relay recorder. He claims it makes possible the distant control of any mechanism by radio.

How to Build a Neutrodyne Set

The Most Authoritative Article on the Subject Ever Published

Approved by Professor Louis A. Hazeltine, Inventor of the Circuit



By J. F. Dreyer, Jr.
Engineer of the Hazeltine
Research Corporation

THE chief advantages of Hazeltine's neutrodyne receiver are its great amplification of weak signals,

a high degree of selectivity, freedom from objectionable squeals and noises; faithful reproduction of broadcast programs; absence of re-radiation (an effect that disturbs neighboring receivers and that is present in most other receivers); and, finally, the unique feature that the several tuning controls are independent of one another and of the filament rheostat settings. This makes it possible to repeat the identical dial settings night after night for any particular station.

The purpose of this article is to describe, for the radio enthusiast who prefers to build his own set, how to construct a standard five-tube neutrodyne receiver, using the standard units. The parts required are as follows (see Fig. 1):

Set of neutrodyne parts, consisting of 3 radio-frequency transformers, with variable air condensers, 4 *B*, and *C*, and 2 neutralizing capacitors, *J* and *K*, panel baffle or hard rubber about 26 by 7 by 3/8 in.

1 baseboard, about 25 by 6 by 3/8 in., 5 vacuum-tube sockets, *D*, *E*, *F*, *G*, and *H* (the kind that mount directly on the panel are convenient)

2 audio-frequency transformers, *L* and *M*

3 4-inch dials

1 6-ohm rheostat, *O*

1 30-ohm rheostat, *P*

7 binding-posts

1 single-circuit jack, *Q*, and 1 double-circuit jack, *R* (see wiring diagram, Fig. 2)

1 fixed condenser, 0.001 mfd., *T*

J. F. Dreyer, Jr. at work in the electrical laboratory of the Stevens Institute of Technology. He is adjusting the neutralizing condenser of the standard five-tube neutrodyne receiver described by him last year and interestingly in the accompanying article

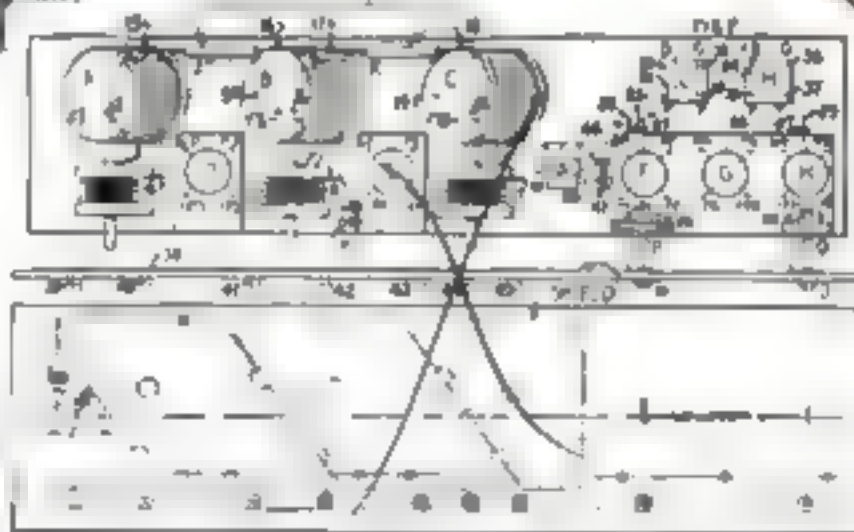


Fig. 1. Diagrammatic layout of the neutrodyne receiver showing position of parts

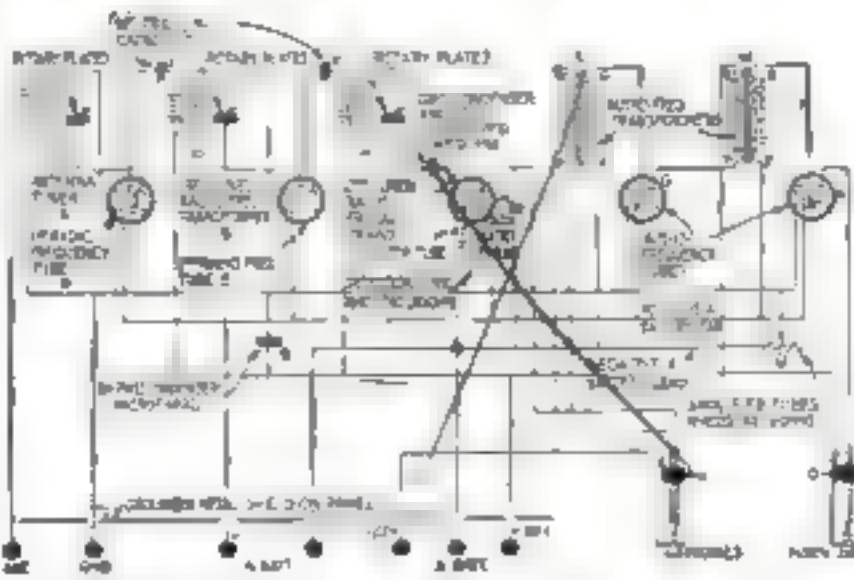


Fig. 2. Complete wiring diagram as approved by Professor Hazeltine



Fig. 3. A piece of paper over one prong of the tube aids in the adjustment

1 fixed condenser, 0.00015 mfd., with clips, or grid leak, *S*
1 fixed condenser, 0.1 mfd. or more, *R*
1 grid-leak resistance, 2 megohms
1 piece of sheet copper for shield, 20 by 4 by 0.010 in., spot. Amately is most any other kind of sheet metal will do if this is not easily obtainable
1 copper wire for connections
Varnished cambric insulating tubing

The neutrodyne receiver is not the easiest type for the home worker to build. This fact will, however, probably make the enthusiastic worker more anxious to try his hand at it.

The arrangement and spacings of the various parts are extremely important, so much so that any divergence from the one suggested is likely to give great trouble to the experimenter.

Figure 1 gives the panel layout and a top view of the receiver. The different parts referred to in the list of materials are lettered, and the points where electrical connections are made are numbered or lettered. A good way to proceed in the assembly is as follows:

Mark off the panel on the back with a scriber, and drill clearance holes for the shafts of the three
(Continued on page 146)

41 St 714 C.

New Tools and Machines Designed



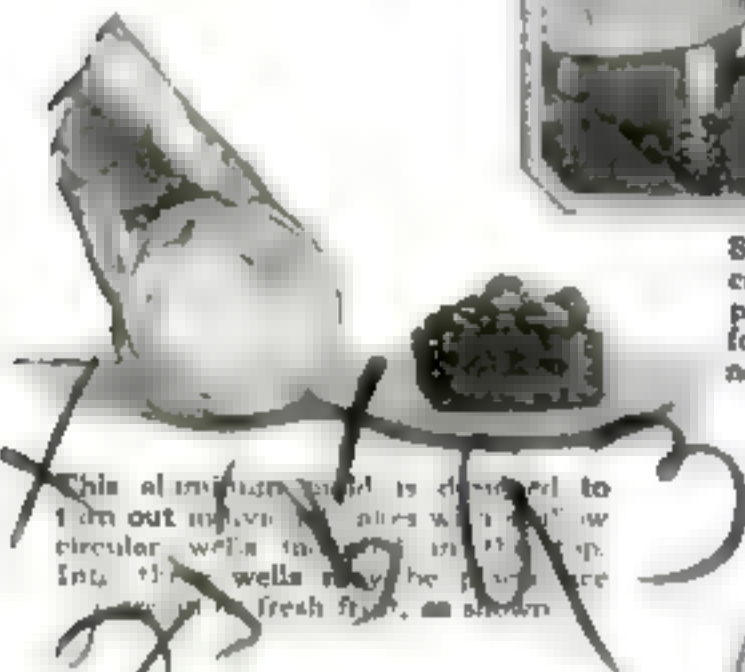
This ingenious four-neck lid is designed to fit any and every container by any diameter within the limits of the largest and smallest things in the lid. The four diameters shown above were selected after tests with hundreds of different containers.



Stove, pantry, and kitchen cabinet all are part of this new storage for every necessity for a meal is within reach.



Through holes in the trough of this squeezer, lemon or orange juice drops as fast as it is squeezed from the fruit into the pitcher on which the device rests. The holes are said to prevent the usual wasteful spilling of juice when poured from the ordinary squeezer.



This aluminum bowl is designed to hold out many apples with four circular wells in the top. Into these wells may be placed fresh fruit, as shown.



Hinged at the center, this novel coat hanger is folded when not in use to form a chair brush with its own set of bristles. When needed, the wire hook is removed.



To take the dirt out of scrubbing dishes and the house, a hand-cranked device is shown. Three turns of crank are all it takes to scrub out the water.



Apartment dwellers will appreciate a new disappearing cedar chest that rolls under the bed so tracks, making use of valuable space that otherwise would be wasted.



Juices from the meat as it cooks in the pan are conveyed to a deep outer depression in the lower gridle.



Equipped with extra large, pliable rubber rollers, a new electric wringer cannot injure the fingers nor break buttons, it is claimed. The frame is made of aluminum.

for the Housewife's Workrooms



Any cylindrical cooking vessel on or from which an electric cooking unit can be attached when it is desired by this electric heating unit. The band is made of heating units in any size for pots of various sizes.



This electric fireless cooker is attached to a light socket and may be used to start and stop at any time in the housewife's absence. The top is reversible, providing an electric grill for broiling and roasting. Two heating units direct the heat upon the cooking food from both top and bottom.



Poached eggs are cooked by placing the egg in the poacher and turning on the heat. A lever raises the rings.



The medicine bottle can be used for any purpose by a rubber band that is secured to the neck and eliminates germs.



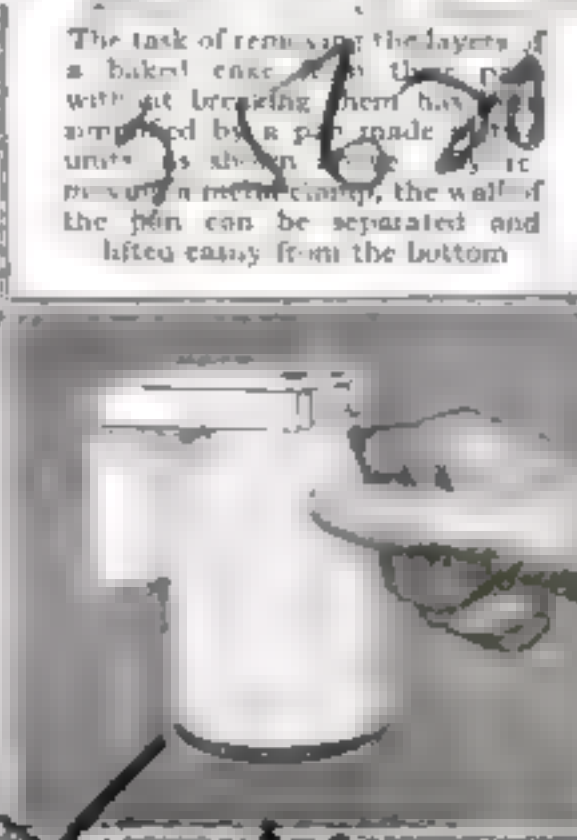
An ordinary plate is converted into a tray by attaching the handle to the plate and turning the ends out to remove the handle.



The task of removing the layers of a baked cake is made easy without breaking them by a special unit. As shown in the illustration, the wall of the pan can be separated and lifted easily from the bottom.



Here is an electrical household servant that quickly cleans, dries, and polishes glass. A center buff polishes the inside of the glass, while four outer buffs give the outside a good polish.



An opener for a bottle hung in this holder is protected from dogs, cats, rain, and snow. The neck slides into the holder.



Winder and washboard are combined in this handy new aid for washday. Springs controlling the top of the rollers are said to permit wringing material that is half an inch thick.

Your Home Garden— How to Make It Pay

An Expert Tells the Secrets of Scientific Vegetable Planting and Cultivation

By Ernest Bader, Ph. D.

PROBABLY no hobby has more adherents than gardening. Few persons who have a plot of ground available fail to cultivate it for there is a strange thrill in watching the seeds you have planted grow to maturity, and much pleasurable, healthful exercise to be derived from working the soil. There is an immense amount of satisfaction, too, in producing good crops and supplying fresh vegetables for your table. It is a satisfaction that any amateur gardener can experience if he will use care in selecting his seeds and will follow a few simple principles in cultivating his land.

How to Start Right

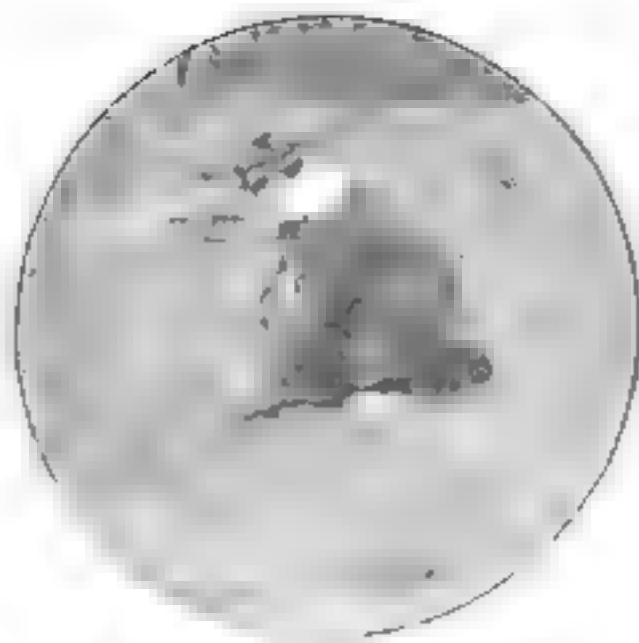
If the land you intend to use for your garden has not been under cultivation before, you cannot grow vegetables successfully there until you have destroyed the acid in the soil by sprinkling the ground lightly with lime. This also loosens the earth, permitting you to work it more easily.

Spade up the ground thoroughly, working the lime into the soil. Then add stable manure for fertilizer, mixing this in thoroughly. Be sure that the manure is well-rotted, since fresh manure is useless for fertilizing. Also, do not use such commercial fertilizers as are especially prepared for the peculiar needs of the professional farmer, for they are not suited to the home garden. Stones, of course, should be removed while the bed is being worked. When the ground has been smoothed off with a rake, it is ready for planting if the land has not been idle for any length of time, the use of lime is not necessary in the preparation of the bed.

Remember that most vegetable plants have their origin in warm countries. Consequently they are not hardy, and they cannot withstand extreme climatic changes. The garden, then, should be located, if possible, in a warm, protected place—one that admits both light and air. Land with a southern exposure makes the ideal location for a garden. Protection for the plants from the wind and

cold usually can be obtained by screening the garden with high plants or with fences to break the force of the wind.

Since most amateur gardeners have no large plot at their disposal, intensive cultivation becomes a necessity. All



In planting seeds a line of stout cord will help keep the rows straight.

A Time-Table for Planting Vegetables

STATES AND SECTIONS	SOW OR PLANT OUT		KILLING FROSTS	
	Hardy Vegetables	Tender Vegetables	Spring Average Last	Autumn Average First
Alabama	Feb. and Mar.	Mar. and Apr.	Feb. 24 to Mar. 31	Nov. 8 to 30
Arizona	Jan. and Feb.	Mar. and Apr.	Feb. 18 to Feb. 23	Dec. 7
Arkansas	Mar. and Apr.	Apr. and May	Mar. 1 to 20	Nov. 5 to 10
Calif., Mid. Sec.	Feb. to Apr.	Mar. to Apr.	Mar. 10 to Mar. 3	Dec. 17
Calif., Northern	Mar. and Apr.	Apr. and May	Apr. 2 to 16	Nov. 13 to 25
Colorado	Apr. and May	Late May and June	Apr. 11 to May 13	Oct. 7 to 29
Connecticut	Mid. Apr. and May	Late May	Apr. 15 to May 3	Oct. 17
Delaware	Apr. and May	Mid. May	Apr. 10 to 20	Nov. 1
Florida South	Jan. to Feb.	Late Feb. and Mar.	Feb. 8 to 14	Dec. 20
Florida North	Feb. and Mar.	Late Mar. and Apr.	Feb. 18 to 23	Dec. 5
Georgia	Feb. and Mar.	Late Mar. and Apr.	Mar. 1 to 24	Nov. 7 to 26
Idaho	Apr. and early May	Mid. May to June	Mar. 20 to Apr. 20	Oct. 25 to 28
Indiana	Apr. and early May	Mid. May to June	Apr. 10 to 16	Oct. 14 to 16
Iowa	Apr. and early May	Late May	Apr. 10 to May 1	Sept. 23 to Oct. 17
Kansas	Late Mar. and Apr.	Mid. May	Apr. 6 to 24	Oct. 14 to 19
Kentucky	Late Mar. and Apr.	May	Apr. 6 to 18	Oct. 19 to 29
Louisiana	Feb. and Mar.	Late Mar. and Apr.	Jan. 24 to Mar. 4	Nov. 13 to Dec. 15
Maine	Early May	Late May and June	May 14 to 26	Oct. 12 to 18
Maryland	Mar. and Apr.	Late Apr. and May	Apr. 4 to 18	Nov. 4
Massachusetts	Late Apr. and May	Mid. May to June	Apr. 10 to 26	Oct. 22 to Nov. 5
M. S. South	Mid. Apr. and May	Mid. May to June	Apr. 30 to May 8	Oct. 10
M. S. North	May	Late May and June	May 10 to 15	Sept. 24 to Oct. 2
Minnesota	May	Late May and June	May 6 to 14	Sept. 22 to Oct. 14
Mississippi	Feb. and Mar.	Late Mar. and Apr.	Mar. 1 to 20	Nov. 2 to 12
Missouri	Late Mar. and Apr.	Late Apr. and May	Apr. 3 to 16	Oct. 13 to 27
Montana	Mid. May	June	May 10 to 12	Sept. 18 to 25
Nebraska	Apr. and May	Late May	Apr. 15 to May 9	Sept. 18 to Oct. 12
Nevada	May	June	May 11 to 29	Sept. 24
New Hampshire	May	Late May and June	May 13 to 20	Sept. 16
New Jersey	Apr. and early May	Mid. May and June	Apr. 11 to 16	Nov. 4
New Mexico	Mar. and Apr.	Late Apr. and May	Apr. 15	Oct. 20
New York South	Apr. and early May	Mid. May and June	Apr. 10 to 14	Nov. 6
New York North	May	Late May and June	Apr. 25 to May 3	Oct. 8 to 19
North Carolina	Mar. and Apr.	Late Apr. and May	Feb. 28 to Apr. 5	Nov. 4 to Dec. 11
North Dakota	May	Late May and June	May 15 to 18	Sept. 13
Ohio	Mid. Apr. and May	Mid. May and June	Apr. 14 to 24	Oct. 15 to 31
Oklahoma	Mar. and Apr.	Mid. Apr.	Apr. 3	Oct. 3
Oregon West	Mar. and Apr.	Late Apr. and May	Apr. 15 to 20	Oct. 30
Oregon East	May	Late May and June	June 3	Sept. 27
Pennsylvania	Apr. and May	Mid. May and June	Apr. 8 to 25	Oct. 19
Rhode Island	Mid. Apr. and May	Late May and June	Apr. 18 to May 3	Oct. 16 to Nov. 10
South Carolina	Feb. and Mar.	Apr. and early May	Mar. 1 to 21	Nov. 8 to 10
South Dakota	Late Apr. and May	Late May	Apr. 20 to May 3	Sept. 20 to 30
Tennessee	Mar. and Apr.	May	Mar. 24 to Apr. 2	Oct. 14 to 28
Texas South	Feb. and Mar.	Mar. and Apr.	Feb. 5 to 2	Nov. 30 to Dec. 23
Texas North	Mar. and Apr.	Apr. and May	Mar. 20 to Apr. 16	Nov. 1 to 19
Utah	Apr. and May	Late May and June	Apr. 23	Oct. 16
Vermont	May	Late May and June	May 13 to 18	Sept. 16
Virginia	Mar. and Apr.	Late Apr. and May	Mar. 2 to Apr. 23	Nov. 3 to 22
Washington	Mar. and Apr.	May	Mar. 14 to Apr. 6	Oct. 17 to Dec. 15
West Virginia	Apr. and May	Late May	Apr. 11 to May 12	Oct. 4 to 17
Wisconsin	Apr. and May	Late May and June	Apr. 21 to May 5	Oct. 4 to 17
Wyoming	May	June	May 19 to 27	Sept. 11 to 16

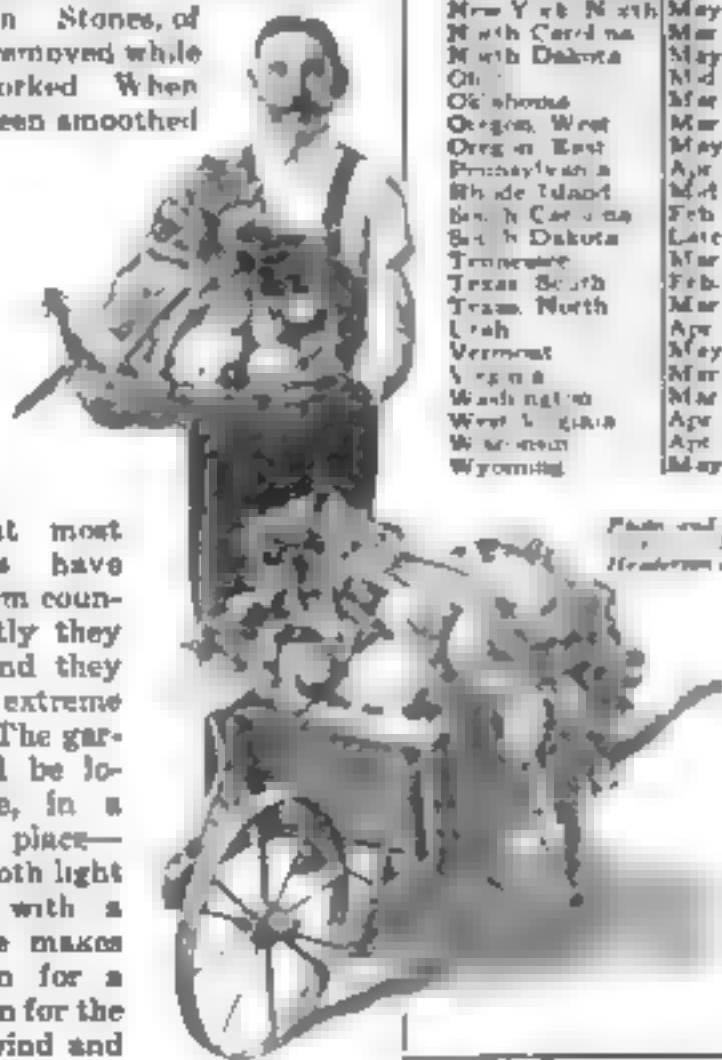


Photo and illustration
Henderson & Co.

THE HARDY VEGETABLES referred to above (the seeds of which may be sown in the plants set out very early even before the last of the frosts are over are:

Asparagus, Beet, Beans, Brussels Sprouts, Cabbage, Carrot, Cauliflower, Celery, Cucumber, Corn, Endive, Eggplant, Kale, Kohlrabi, Lettuce, Onion, Parsley, Peas, Potato, Radish, Rhubarb, Salads, Squash, Turnip, and Watercress.

THE TENDER VEGETABLES the seeds of which should not be sown in the open, nor the plants set out until both weather and ground are settled and warm, are:

Beans, Corn, Cucumber, Eggplant, Melon, Okra, Pepper, Pumpkin, Squash, Sweet Potato, and Tomato.

If you are setting out a backyard vegetable garden this spring, cut out this table and tack it up where you can use it for handy reference.

available land must be under cultivation continuously during the gardening season if a maximum yield of crops is expected. This effect usually is obtained in a small garden by sowing the seeds of plants that do not come to maturity until the fall in beds that already have yielded a crop of early vegetables.

Intensive Planting

It is quite feasible to sow early and late vegetables together in the same bed. The early vegetables develop so rapidly that they can be harvested before the late vegetables have begun to develop.

The rotation of crops, so necessary in large farming operations, is even more important in the small garden. That is, the same beds must not be planted for the same crops year after year. Different plants absorb different elements from the soil in the process of growth, and it is virtually impossible to replace these elements by fertilizing. You cannot increase the yield of your garden by planting thickly. A given area of ground can produce plants only up to a certain limit, and crowding the plants will cause them to die.

Owing to climatic differences in various sections of a country as large as the United States, it is impossible to lay down any hard and fast rule as to the proper time for starting your garden. You should wait, of course, until you are certain that the frost is out of the ground, and you should delay planting until the soil is well prepared. Sowing the seeds a few days late is preferable to losing your crop because the seeds have been placed in poorly prepared soil. A sandy soil, which heats more quickly, permitting heat to reach the roots more readily, can be sowed earlier than a clay soil.

Begin planning your garden early in the year, deciding definitely on the location of the various plants and drawing a diagram of the land you intend to cultivate. This will avoid loss of valuable time when you are ready to sow.

An Early Start with Hotbeds

Hard seeds will germinate more quickly if they are soaked in warm water—about 120° F—for about 12 hours before planting. The planting, however, should follow immediately the soaking of the seeds.

A hotbed for the cultivation of seedlings will enable you to start certain vegetables as early as February or March. If you can obtain a few old windows, you can make an excellent hotbed by constructing box frames of 12-inch lumber, using the windows as glass covers. These should face the south or southwest, with one

The Right Way to Grow Seedlings



Place flat wires in the seed box for good drainage



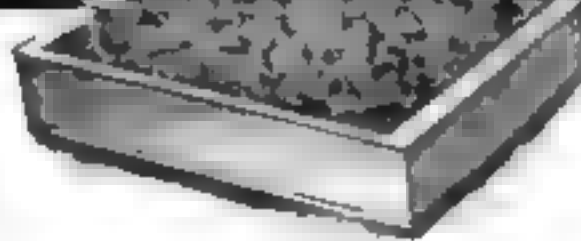
Fill the box with layers of manure and rich soil



Plant the seeds in shallow rows, leaving an interval between rows in the box



After the seeds are planted, fill the hills with soil, covering the seeds



A box of vegetable seedlings ready to be transplanted in the garden

end raised so that the box slants toward the sun at an angle of about 30 degrees. Fill the box to the depth of about a foot with decomposing manure. Moisten, pack down and cover with four or five inches of good soil. Insert a thermometer about two inches in the soil, and, when the temperature has risen and then fallen to 90 degrees (which will be in from five days to two weeks), the hotbed is ready for planting. Hotbeds should be watered and ventilated every day and their glass coverings should be raised to prevent the

intense heat that is produced in them on fair days from harming the plants. Plants started in a hotbed, of course, must be transplanted to the garden later in the season.

Regarding the intensive cultivation mentioned before, the first crop from your garden should consist of early vegetables, such as beets, spinach, radishes, and lettuce. After these have been harvested, say in May or June, the ground from which they have been taken may be replanted with late vegetables, after it has been thoroughly worked and fertilized. Early and late vegetables also may be planted together fairly early in the season, the late varieties being planted between the early rows.

Watch and Weed

After watering your garden and after every rain, see that the soil does not crust over and crack open. If this occurs, the whole garden should be thoroughly hoed to loosen the soil. This will also give a splendid opportunity to remove weeds. Weeding, of course, should be performed regularly, since weeds are intruders and robbers that steal from the soil the nourishment your plants require.

Little hills or mounds of soil made with the hoe about the lower stems of such plants as beans, peas, potatoes, cucumbers, tomatoes, pumpkins, cabbages, Brussels sprouts and celery, will protect the plants from too rapid

evaporation of the soil moisture, and will prevent the cold water from hose or watering can from injuring the roots. In addition, a large number of roots will form in these mounds, anchoring the plant firmly in the soil and making it almost impossible for a strong wind to uproot them. Such hills in a row also form the sides of shallow troughs that prevent the water from running off the bed.

The tools required for a small garden include a spade, a hoe, a rake, a hand weeder, and a length of stout cord to guide you in placing your rows in orderly, straight lines. With these, a little interest, and intelligent care, the most inexperienced gardener will achieve astonishing results.



After the soil has been worked rake the bed smooth, removing all rocks and pebbles

IT WOULD save trouble and expense, wouldn't it, if coal could be piped from the mines direct to your furnace, just as electricity and gas now are delivered from central stations? Read, in next month's issue, about the recent successful experiments with "black flour," the world's newest fuel.

New Additions to Car Enjoyment



One of the new devices to shield the driver's eyes from glare is a transparent protective film which is applied to the window glass. It does not obstruct vision.



Greater resiliency, shock absorption, and improved tire mileage are claimed for this new type of spring wheel. The hubs are flexibly mounted, giving a sort of floating wheel action.



Smoking convenience while driving is provided by the three compartments of this compact cigarette case. One compartment holds a cigarette and provides a place for the lighter. The other compartments are used for the matches and ashes.

Identifying a trouble-free spark plug has been made easy by the use of this new device. The tip of the plug is tested by the strength of the spark it produces.



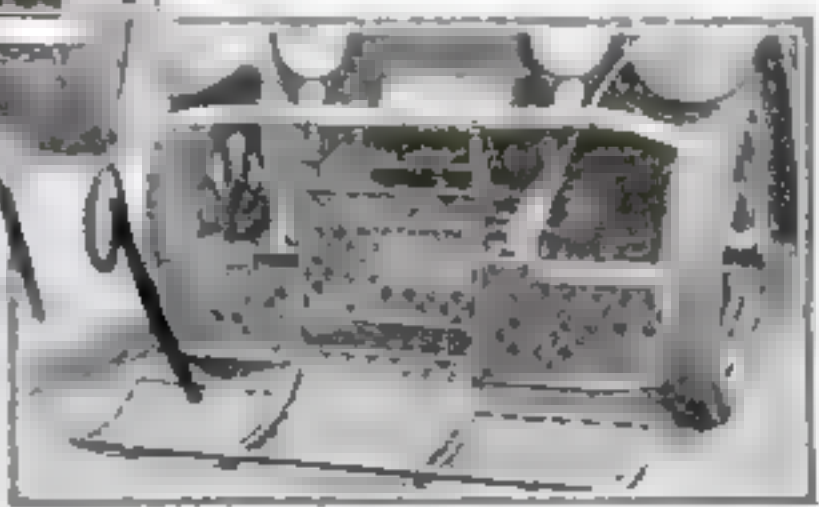
The car that is stuck fast in a mud hole can climb out under its own power and be freed with the aid of this emergency mud shoe. It holds six spikes bordered by two chisel-like ridges.

Depressing on the end of the quality of an inner rubber ball the new shock absorber shows at the bottom right. The ball is inflated like a tire.



A safe and comfortable ride for the baby is the purpose of this riding car seat, which is attached to the front or back seat of the car with straps.

Combining new appearance with effective safety, a new safety device is shown above until it strikes an object or until released by the driver. Then it drops to the position shown at right.



Less than two pounds pressure is required, it is claimed, to release the safety fender, which is said to open at the instant of impact.

Are YOUR Headlights Dangerous?

How to Stop the Blinding Glare that Invites Disaster at Night

By F. A. Platte

Instructor, Department
of Physics, Columbus
University

CRASH!

I stopped my car, and peered back into the night. Two cars were locked together in the middle of the road. I put my motor in reverse and backed up to them, believing I should have to carry some one to the hospital; but I was relieved to find that damage had been done only to the cars. Each driver was blaming the other for the accident, and it was some time before I learned what actually had happened.

Dazzled by the other's glaring headlights, one driver had been unable to see the road before him, and had headed his car directly into the other.

Who was to blame? There is only one answer. It was the driver who, through ignorance, carelessness, or selfishness, had operated the car with glaring headlights.

Bright Headlights Confuse Drivers

Every motorist has experienced the inconvenience and worry of night driving caused by approaching cars with headlights that throw blinding beams into his eyes. If the glare is especially bright, a driver virtually loses his sense of direction, and, if inexperienced, is likely to swerve his car unconsciously and to meet disaster. In fact, even an experienced motorist cannot feel absolute security against the menace of the glaring headlights of other cars.

Glaring headlights are unnecessary, and they are almost as dangerous to the car that carries them as to the cars that may be passed, for, when your headlights dazzle another motorist, it is more than likely that it will be your car he will hit. So for your own safety you should make sure your headlights are properly adjusted.

Inspect and Adjust

Periodic inspection and adjustment of the headlights are essential to the elimination of glare. These operations are simple and require little time. Two things are to be considered—the proper location of the



If your headlights cast a blinding glare into the eyes of the other fellow on the road, you are not only liable to have him hit you, but you are also liable to be hit by him. The picture above will tell you just how dangerous it is.

1. Be sure each lamp is in focus.

2. See that each light beam is directed so that the top of the beam is at the level of the lamp.

3. Equip the lamps with anti-glare lenses.

4. Be sure the lenses are right side up.

5. Use lamp bulbs of not more than 21 candlepower.

6. Examine and test your headlights frequently, according to directions on these pages.

lamp in its socket and the angle at which the light beam leaves the lens.

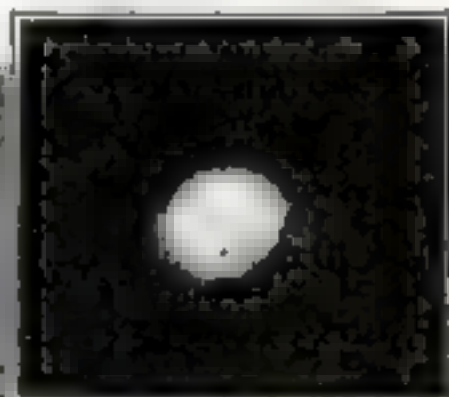
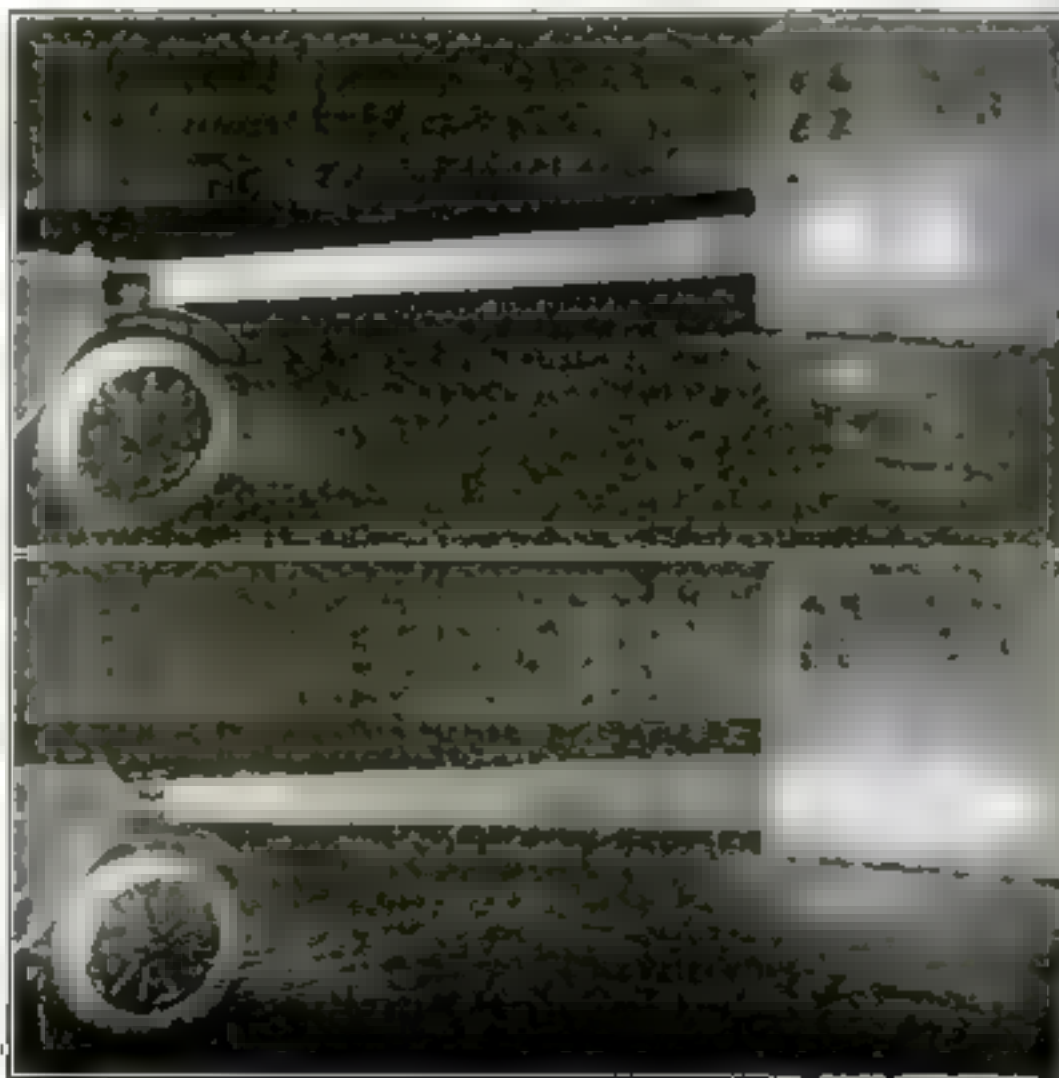
To determine whether the lamps are properly focused, drive the car, fully loaded, toward a wall or other flat, vertical surface and stop about 75 feet away. A shorter distance will serve, but it should not be less than 25 feet.

To Test Lights

Now remove the lenses. Cover one lamp and note the shape and size of the reflection that the other casts on the wall. Turn the screw or other adjusting device with which your lamp is equipped until you have produced the smallest and clearest possible reflection on the wall. This reflection, to be most efficient,

should be circular in shape.

That lamp now is in proper focus. By turning the adjusting screw, you have moved the lamp backward or forward until it has reached the particular point in relation to its reflector that is called the focus. When the lamp is in this position, all rays of light emerge from it in parallel lines. When the lamp bulb is in front of the focus, the rays cross; when in rear, the rays diverge. In either case in which



Above: Reflection of a car's headlight on a wall with lens removed. A circular reflection indicates correct focus.



Above: Oval reflection, correct focus with lens in place. At the left: Correct combined reflections.



Correct beam reflection at a distance of 25 feet produces a small, solid round spot focus as in Fig. 1 at the right. If the reflection is at automobile lamp level

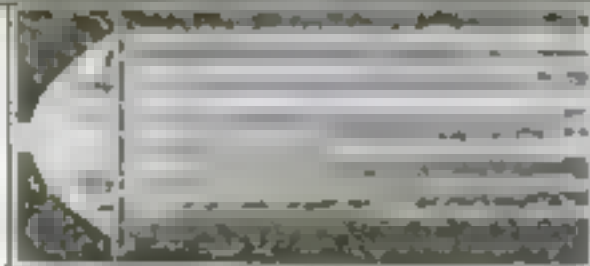


Fig. 1. Lamp bulb at focus, eye parallel

Image as seen in reflection of a vehicle at 25 feet. If the reflection is at automobile lamp level, the beam is at focus.

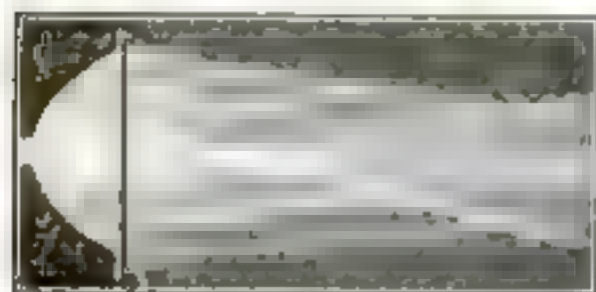


Fig. 2. Ahead of focus; rays converge



Fig. 4. Behind focus; rays diverge



Fig. 3. Bad reflector; rays scattered

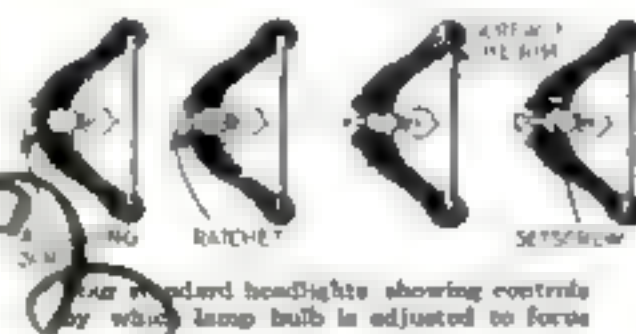
the lamp is out of focus, the reflection on the wall will be a large ring and not a small, solid round spot. The rays that compose the upper portion of this large ring are the dangerous ones that are projected into the eyes of approaching motorists. Adjust the second lamp in the same way.

Having completed these adjustments, replace the lenses on the lamps, making sure that they are right side up. Immediately the reflections on the wall will become oval in shape. The reflections of lamps should combine to produce a flat oval reflection. When this is obtained, the lights should be adjusted for height of beam. The top of the beam should be at the level of the lamp, or at about the height of the mounting of a grown person. When a light car this level should be even lower, for when several heavy people enter the car, their weight tilts the front end.

Correct Headlight Angle

Most cars are provided with an adjusting device to tilt the headlights. If your car is not provided with an appliance of this sort, you must bend the lamp brackets until the proper beam level is obtained. If when you sit in your car, you can see with reasonable clearness the head or neck of a person standing from 25 to 75 feet away, the beam cast by your lights is too high. Either the focus must be changed, or the lamp must be tilted down.

In addition to the two all-important considerations mentioned above, the lights can be improved further by



using anti-glare lenses and polishing the reflectors with a soft cloth dipped in powdered lampblack. The various makes of special anti-glare lenses are of two kinds

Diffusing and deflecting. Diffusing lenses focus on ground glass and scatter the beam. Deflecting lenses merely take those beams that project upward and bend them down so that none will rise above the lamp level. Although most of these devices will accomplish the desired purpose, there are some which bend the rays down so much that they strike the road just in front of the car. While this eliminates glare, it also eliminates a good view of the road.

Another important consideration is that the lamps be of proper candlepower. Too intense a light from the lamp will produce too sharp a beam. Even though this may not shine directly into the eyes of an approaching motorist, it may be strong enough to cause him annoyance.

If you follow these precautions, you will find you have an ideal light preceding your car—one that will illuminate objects sufficiently, one that will throw its brightest rays on your side of the road; and sufficiently close to the car to see the road ahead; one that will permit you to view the full width of the road for at least 200 feet, but without casting a dangerous light into the eyes of other drivers.

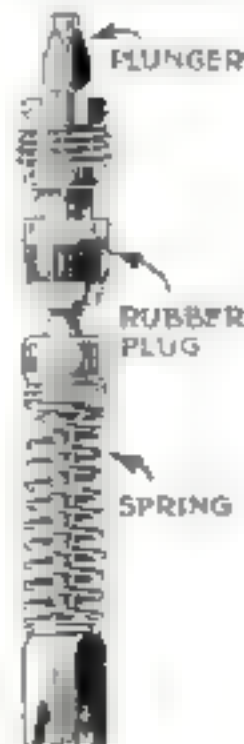
Furthermore, you will be spared the annoyance of continually turning on and off your lights, a dangerous practice in itself.

Know Your Car

The Valve Inside. This small, but important piece of mechanism, consisting of a plunger faced on one end with a rubber plug and surrounded at the bottom by a small spring, plays a vital part in the life of your automobile tire. Inclosed within the tire valve stem, it is the mechanism that opens to permit the entrance of air during inflation, and automatically closes to hold the air within the tire tube during service. In large pneumatic tires it is called upon to hold back a pressure of more than 100 pounds, a pressure that increases with severe road jars.

During inflation, air pressure from the pump forces the plunger inward against the spring. As soon as this pressure is released, the spring forces the plunger back into position, where the rubber plug acts as a washer to prevent escape of air from the tire.

The valve cap always should be screwed firmly over the valve stem to keep out dirt and to provide a secondary seal against escape of air.



IN ANOTHER useful article next month, Mr. Platte will tell how you can get more miles to a gallon of gasoline.



The Home Workshop

Arthur Wakeling, Editor

Chinese Game Table Has Every Playing Aid

COLORFUL, picturesque, and fascinating as is the ancient Chinese game that has become, under its many aliases, one of the leading indoor pastimes of the country, it is doubly enjoyable when played at a properly equipped table.

Many costly sets are being used on rickety card tables with loose tile racks that do neither the game nor the set full justice. The table should be especially built for the game, with convenient racks and counter holders and a felt-covered playing surface for building the wall of tiles; and it should have a finish and style to match the workmanship and appearance of the Chinese pieces and beautiful cabinets in which they are stored. Such tables can be purchased for prices ranging from \$25 to \$75 or more. The cost of making them, however, is very much less, especially as expensive hard woods need not be used.

The table illustrated, which was designed by George F. Kuercher, of Philadelphia, a furniture factory

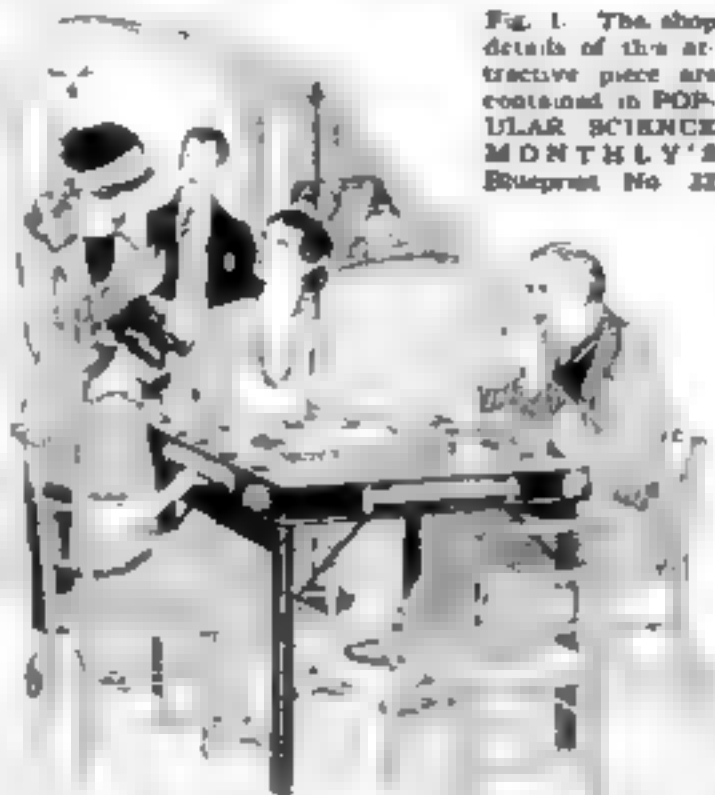
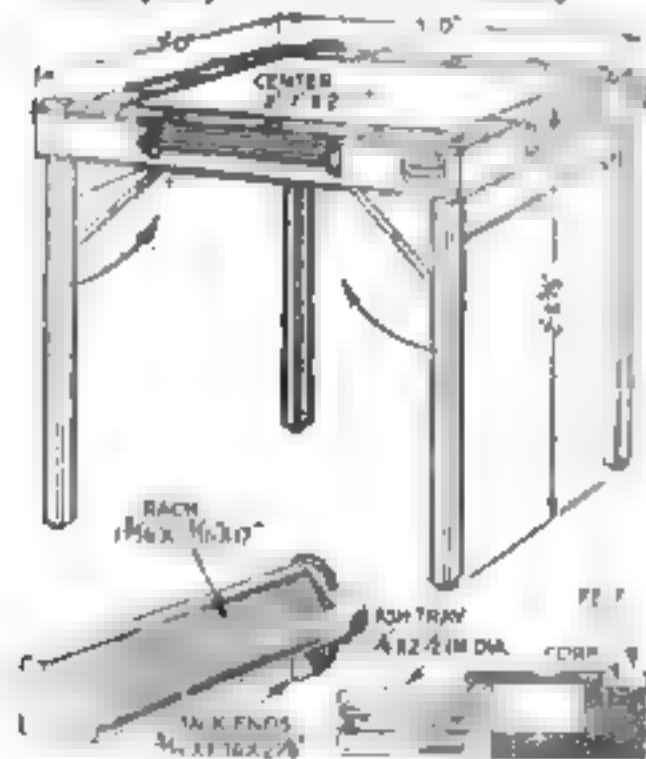


Fig. 1. The shop details of this attractive piece are contained in POPULAR SCIENCE MONTHLY'S Blueprint No. 22

The foundation of the table top is a base made of four pieces of white-wood $\frac{1}{2}$ by 3 $\frac{1}{2}$ in. by 2 ft. 11 $\frac{1}{2}$ in., mitered and doweled together to form a frame. To one flat under surface of this frame is hinged the pair of longer legs with 1 $\frac{1}{4}$ by 2 $\frac{1}{2}$ in. hinges. To the rail that connects the other two legs is screwed a hinged filling piece $\frac{1}{2}$ by 1 $\frac{1}{2}$ in. by 2 ft. 7 in. Two hinges are fastened to this filling piece and also to a heavy block 1 $\frac{1}{4}$ by 3 $\frac{1}{4}$ in. by 2 ft. 10 $\frac{1}{2}$ in. This block, which lies flat against the under side of the table frame, is notched out, as shown in Fig. 3, to permit the ends of the legs on the other side to enter it when they are folded.

The rim of the table is made of four pieces $\frac{7}{16}$ by 4 in. by 8 ft., mitered and doweled. The top and bottom outside edges of these pieces are beaded to give a finish corresponding to the legs.

The racks, which are fastened to the rim, as shown in Figs. 1 and 2, are made from pieces 1 $\frac{5}{16}$ by 1 $\frac{5}{16}$ by 12 in., with ends cut from pieces $\frac{5}{16}$ by 12 in. (Continued on page 118)



superintendent, combines all the features desirable for comfort and convenience in playing the game and at the same time has the appearance of fine workmanship and finish sometimes lacking in even expensive commercial tables.

While the table shown in the central illustration (Fig. 1), will fold up and can be stored away in a relatively small space, it is of substantial construction throughout. Non-folding variations of the same design are equally practical, in which case legs of any of the three types shown in Fig. 2 are alternatives for the plainer legs illustrated in Fig. 1.

The racks for the tiles are fastened to the rim of the table. The counter holders are semicircular troughs or bins that run around the edge. Ashtrays are also provided for the convenience of those who like to smoke while playing.

The top is 8 ft. square, the overall height is 2 ft. 8 $\frac{3}{4}$ in. The legs, like all the other parts, unless otherwise noted below, are maple, oak, or poplar. They are 1 $\frac{1}{4}$ in. square and two of them are 2 ft. 6 $\frac{3}{4}$ in. long, the other two being 2 ft. 4 $\frac{3}{4}$ in. The corners of the legs are relieved by being beaded, as shown in Fig. 2, but other styles have the square legs with the edges only slightly rounded or plain tapered legs.

The two longer legs are connected by a rail $\frac{1}{2}$ by 6 $\frac{1}{2}$ in. by 2 ft. 7 in., to which each is fastened with three $\frac{3}{8}$ -in. dowels. The two shorter legs are similarly fastened to a rail $\frac{3}{4}$ by 4 $\frac{1}{2}$ in. by 2 ft. 7 in.

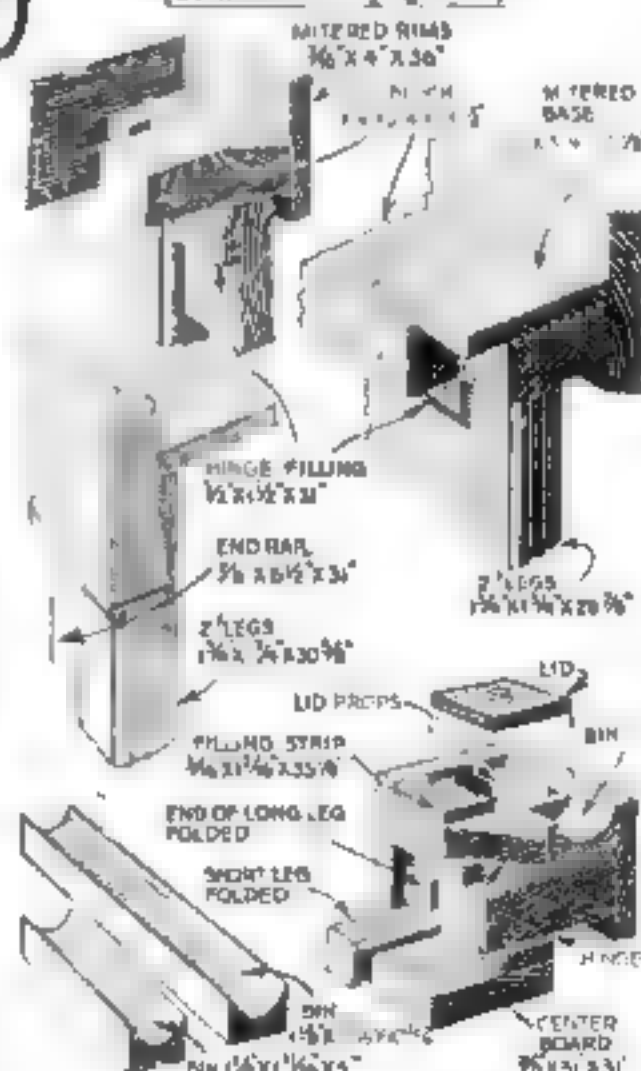


Fig. 3. The corner construction with legs open is shown at top, and with legs folded, below

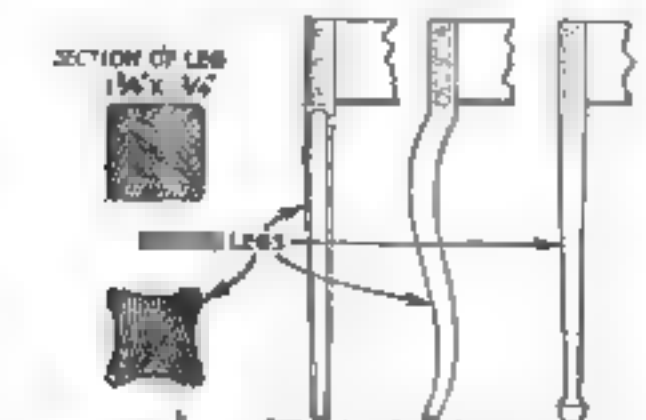


Fig. 2. The table, three alternative leg designs, and details of corner bins and ashtrays

New Furniture Salvaged from Old



By Capt. E. A. McCann

MY POSITION was perhaps a little unusual, though it is the kind of thing that, with variations, is likely to happen to many. I took one floor of a house that was being reconstructed and found therein six bureaus and commodes, all very dilapidated and apparently only fit for kindling-wood. They were, however, made of good oak, and it struck me that they might be converted to my use, thus saving the buying of new furniture, which would most likely not be so suitable and certainly would not have the same interest for me.

Two of the chests of drawers I painted thoroughly with linseed oil and carbolic, sanded, tightened up the screws a bit and enamelled to go with the color scheme of the room. As this room had not too much light, I papered the walls a corn color, used light blue curtains and cushions, and enamelled the furniture a rich, tawny yellow, with a pale blue stripe.

One of the bureaus was a small sawed-off highboy. In this I left the lower batten and drawer-slide and shifted the middle one halfway between. Then, from the old drawers, with the addition of some spare wood, I made two drawers and partitioned them so that one side of each would take letter folders.

The balance of the space in the top one was left for a card index, envelopes,

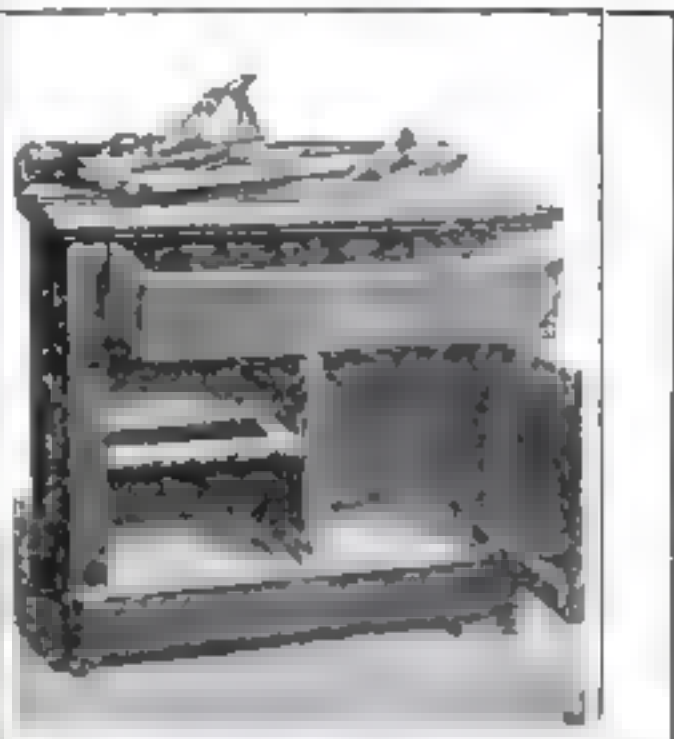


Above at left: A rebuilt stationery cabinet. Center: A dresser and at right: the dilapidated commode from which it was built.

notebooks, and the like, and in the bottom drawer I put a slide halfway up to take ink and other bottles, rubbers, and writing materials, with room below for compasses, and other drawing equipment. I put easy running casters on this and now have a handy cabinet for my writing material, which I can either work on or, better, draw up to the table. This saves me a lot of walking about.

The bookrack on top is made from a piece of packing case with a nice grain, stained green. It is just two frames about 14 by 10 in. hinged together in front, with hinged legs on either side and a narrow ledge in front.

One of the commodes I made into the little Welsh dresser shown by fitting a new door on the left and raising the back with shelves. I used the posts and panels at the sides of the shelves to carry out the same pattern as the sides below. The back I panelled quite flat with 3-in. whitewood. The shelves are of oak from



another piece with narrow battens to keep the plates from slipping.

This piece I painted to match with the same blue stripes, but with the addition of designs on the doors and drawer, as they looked rather blank. The motif below is based on hunting implements, because that is where the food is kept, but on the drawer it is weapons, as a warning, because the "near" silver reposes there. With blue and white china, ranging from 10 cents a piece to valuable Chelsea and Chinese, it looks fine.

I kept all the furniture short, as the ceiling is not very high. One must always think of these things when furnishing.

The handles all through are just cheap pierced brass, but I enamelled them blue and then rubbed off the high lights with a cloth pad so that they have the polychrome effect.

Thus it will be seen that with some ingenuity and the aid of simple tools and paint or, if you prefer, stain and varnish, many apparently worthless pieces of furniture can be made into something quite handsome, that will be much nicer, at any rate to you, than what you buy ready made, and the saving is considerable.

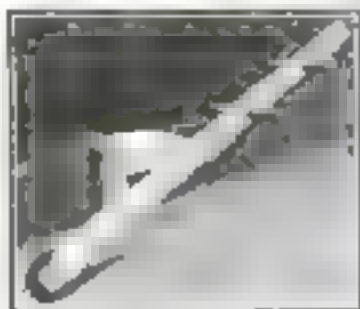
Incidentally, in the basements of most apartment houses and many homes may be found quantities of dilapidated furniture that may be had for a smile, perhaps aided in some cases by a small tip.

Boys Enjoy Speedy Coasting with Roller-Skate Scooter

By Dale R. Van Horn

FUN in roller skating on smooth pavements is doubled with this light, speedy, one-wheel scooter. Carrying it, the skater speeds along as fast as he can go. Then he swings the scooter between his legs, sits down on the seat, and, with the knee rest upon his knees, coasts as far as the momentum will carry him.

The materials can, for the most part, be salvaged from the scrap pile. The hardwood wheel is 4 in. in diameter and 1 in. thick. It will have



Built from wood picked up from the scrap pile, this unique scooter adds immensely to the sport of roller skating.



to be turned in a lathe, cut with a keyhole saw, or shaped with a chisel after the stock has been mounted on any revolving spindle. The main bar should also be of hard wood, although this is not absolutely necessary, and the joints should be screwed.

The accompanying illustration shows how the parts are assembled, and how each is shaped. When painted in bright colors and carefully finished, this device will insure any boy many hours of happy outdoor sport.

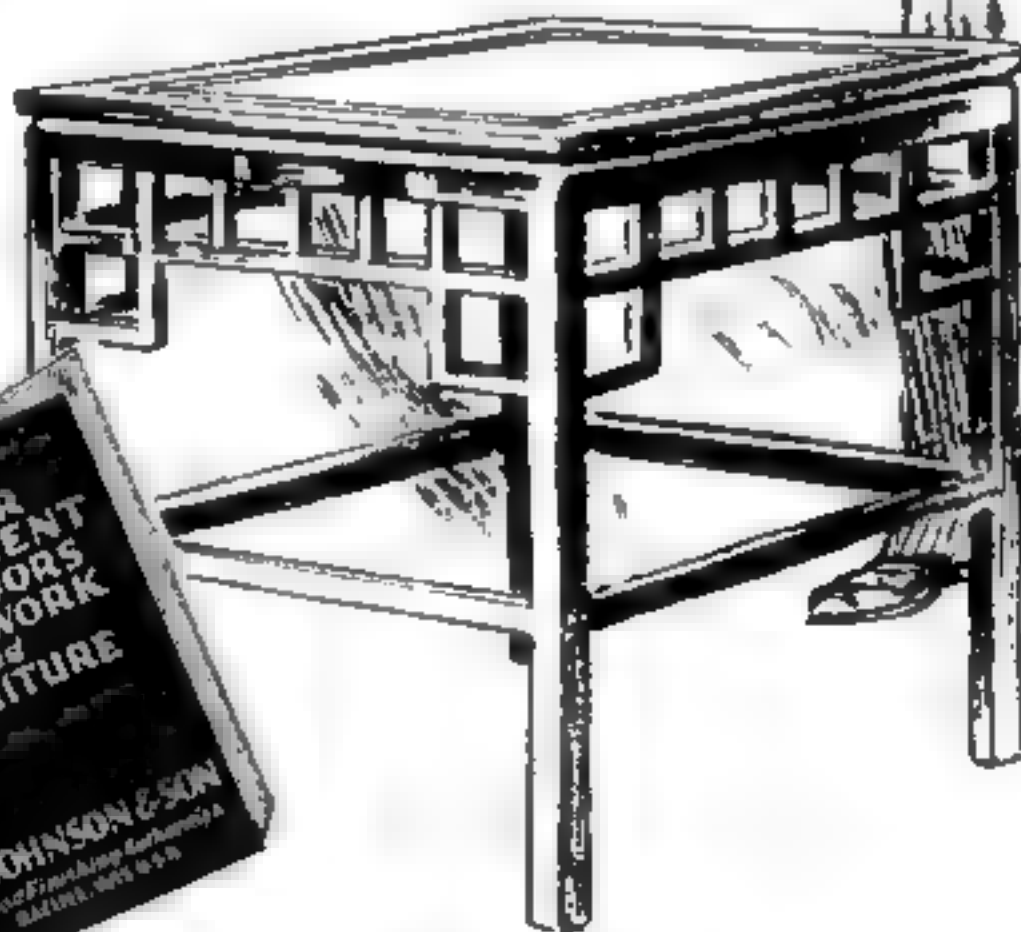
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How to Construct a Modern Built-In Buffet

By Edwin M. Love

MANY recently constructed houses have built-in buffets, dining alcoves, bookcases, and the like, but the majority of small dwellings have none of these conveniences. Perhaps nothing in woodworking brings greater satisfaction to the home mechanic than the building of features of this kind, which are well within the ability of any man who can make good joints in wood.

The buffet illustrated is a recent design that has proved popular in new houses. As it stands out in the room rather than in a recess, it can be built into an old house as easily as in a new.

The construction is relatively simple. No elaborate cabinet work is necessary. In fact, all the joints are nailed except those in the doors, and the doors usually can be obtained quite reasonably at a sash and door mill. Wood to match the trim of the room should be used if the buffet is to be varnished, or pine or any easily obtainable soft wood, if it is to be enameled.

Once the method of building the buffet is understood, it is easy to modify the proportions and design to suit any given room. The one illustrated is in a large dining-room and its proportions are generous. The top or countershelf is 2 ft. by 6 ft. 8 in.; the height of the buffet proper is 3 ft., and the mirror back extends 1 ft. 6 in. more, making the total height 4 ft. 6 in.

The mirror is the most expensive item, in this case costing \$18. The lumber cost \$14.50, the doors \$7, and the hardware \$2.20. The building time was 80 hours.

Draw on the floor the outline of the frame of the buffet, making the length 6 ft. 8 in., the width 20 in. at the ends and 28 in. at the partitions. The partition lines are spaced 1 ft. 8 in. from each end and like the end lines are squared out from the wall. Nail cleats on the floor $\frac{3}{4}$ in. inside of each end line, and $\frac{3}{4}$ in. to the side of each partition line, and plumb up lines on the wall from these.

Glue up the counter shelf, ends, and partitions, using corrugated joint fasteners every 12 in. on the under side. While the glue is drying, nail on the wall cleats. Measure up from the floor 2 ft. 11 in. and level across. Nail a 1 in. by 3 in. cleat to the wall with eightpenny nails, being careful that the ends do not project beyond the end plumb lines. Lay off the following distances from the top of this cleat downward: 4 in., 4 in., 2½ in., 4 in., 2½ in., 5¼ in., 2¾ in., 5¼ in. Rough 2¾-in. cleats are leveled across from these points to support the rear ends of the drawer slides, as shown in the perspective illustration of the frame.

When the glue-up stock is dry enough, surface the end pieces and partitions and scribe them to the wall, being sure to keep the front edges plumb. Nail to the floor cleats and tack a brace across the tops to keep the pieces in position.

The hanging stiles are next cut to length, the corner stiles mitered to the ends, and the drawer stiles shaped to the proper angles by plan-

narrow strips are cut between the upper rail and cleat to prevent the upper drawers from sagging when opened. At the back end of each slide nail a block to the wall as a drawer bumper so as to prevent strain on the edges of the drawer fronts.

Nail 1 by 1½ in. shelf cleats to the ends and partitions, placing the lower cleats so that the shelves will project ½ in. above the bottom rails to form door stops. The upper shelves should be 1 ft. 6 in. above the lower. Counter-shelf cleats are put in as indicated.

Surface the counter shelf, flatten the under side where it bears against the cleats, cut to a length of 6 ft. 8 in., and scribe to the wall. Nail securely to the cleats, and then cut and dress the front edge, allowing a projection of 1 in. beyond the stiles and rails. In putting on the wainscot cap edging, allow a ¼-in. margin on shelf. Make all the angle joints accurately and glue

as well as nail them securely. Fit the 2-in. cove underneath, then fit the base and shoe.

The mirror frame is mitered. Except at the top, where 8-in. stock is used, the frame is 1 by 1½ in. Before installing the mirror, paint the molding, as the back edge will be reflected in the glass.

In hanging the doors, be careful to allow about 1/16 in. all around for clearance if the buffet is to be painted. If it is to be varnished, the clearance may be a little less.

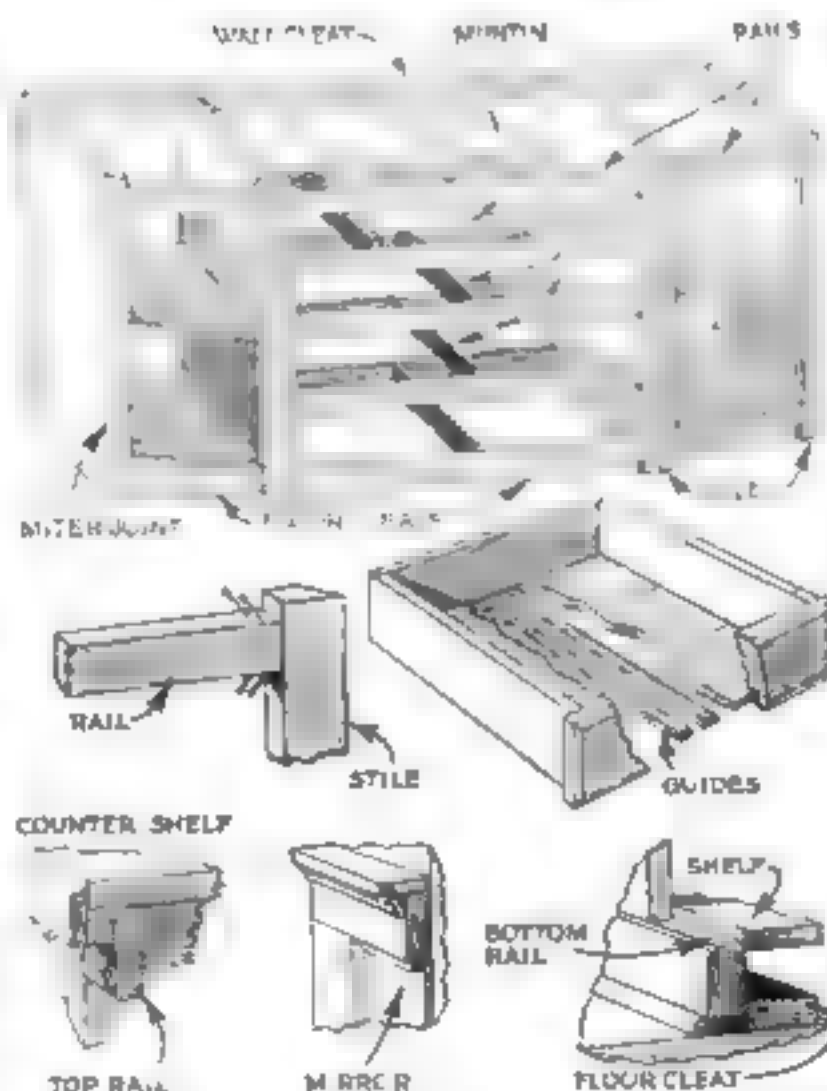
All the woodwork should be carefully scraped and sanded before finishing in either varnish or enamel, as the least rough spot, plane mark, or open joint will show.

Hardware, other than the hinges used for hanging the doors, should not be put on until the finishing is complete.

The bill of materials follows:

- 3 pc. 1½ by 2½ in. net, by 16 ft. "4s"
- cuttered on all four sides
- 1 pc. 1½ by 1½ in. by 12 ft. "4s"
- 1 pc. 1 by 3 in. by 14 ft. "4s"
- 2 pc. 1 by 1½ in. by 12 ft. "4s"
- 3 pc. 1 by 1½ in. by 12 ft. "4s" for shelves and ends
- 1 pc. 5 by 12 in. by 14 ft. "4s" for counter-shelf
- 1 pc. 1 by 6 in. by 14 ft. "4s" for drawer front
- 2 pc. ½ by 4 in. by 10 ft. "4s" for drawer sides and backs
- 24 sq. ft. of ½-in. drawer bottom
- 1 pc. ¾ by 16 ft. quarter round, mirror molding
- 1 pc. 1½ by 4 ft. cove for mirror shelf
- 1 pc. 2 by 12 ft. cove for counter shelf
- 1 pc. ¾ by ¾ in. by 12 ft. nose shoe
- 1 pc. ¾ by 2½ in. net by 12 ft. wainscot cap
- 1 pc. ¾ by 4 in. by 12 ft. baseboard
- 1 pc. 1 by 6 in. by 18 ft. sheathing to be ripped down center for floor and wall cleats, drawer slides, etc.
- 2 sash doors to fit open nas
- 2 pair 2½ by 2½ in. nose pin butts (all brass)
- 50 corrugated ½-in. steel fasteners (clasp nails)
- 10 drawer knobs for drawers and doors
- 2 large catches
- 1 12 by 75 in. plate mirror

In ordering, it should be remembered that surfacing of finished stock reduces the actual dimensions ¼ in. to ¾ in. below sizes ordered, unless marked "net."



The completed buffet, the general construction of the frame, and details of drawers, countershelf edging mirror cap, base molding, and method of nailing together rails and stiles.

ing a bevel on one half of the width only. The thinner edges are placed on the drawer side.

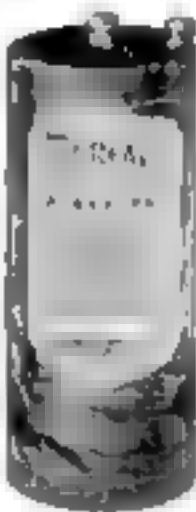
Cut the rails between the stiles, getting the positions by leveling across from the tops of the cleats. Toenail the joints with 4 sixpenny finishing nails, as shown, and nail in the muntin.

The drawer slides, made of 1 in. by 3 in. stock, are placed in the center of the drawer openings, the upper edges projecting above the rails ½ in. Two

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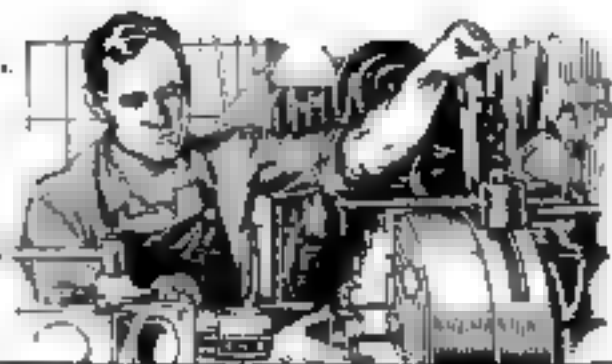
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Better Shop Methods

How Expert Mechanics Save Time and Labor



Speedy and Accurate Ways of Boring

ERROR in machining. Score in finished bore of cylinder casting. Mechanic Joseph Dyson. Hired Feb. 20, 1922. Reported for inspection and action.

This report was the signal for the dismissal of mechanic Dyson. He had not studied the methods of finishing very carefully and as a result had used too little lubricant. This ruined the casting and he lost his job.

While most mechanics know something about tools for enlarging and finishing cylindrical openings and realize that various kinds of boring tools are available, there are few who have studied boring operations sufficiently in relation to speed and accuracy. Many machine hands are lost when it comes to finish boring holes of large diameter or in work of unusual character.

Before starting a boring job, the mechanic should analyze the situation and decide on the type of tool that will give the best results. He must then see that all the cutting edges are in good condition. A proper holder must be selected so that the tool won't slip and gouge the work. Lastly, he must make sure that the proper kind of lubricant is fed to the cutting edge in sufficient quantities to insure best results.

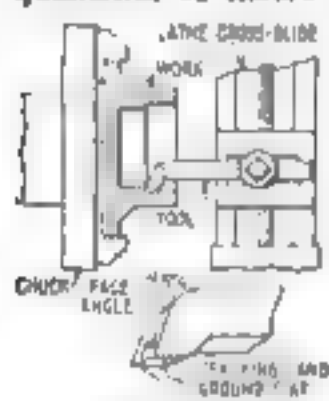


Fig. 1

A dependable practice for lathe boring is a fixed cutter in the tool-post of the cross-slide. It must be sufficiently long, as shown in Fig. 1, to make the complete bore without shifting the tool. The angular shaped nose of the tool

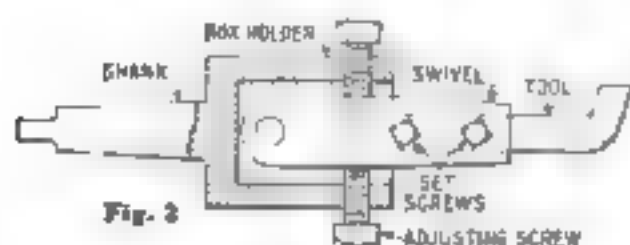


Fig. 2

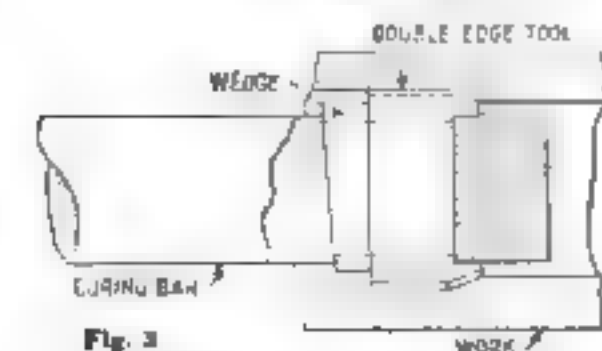


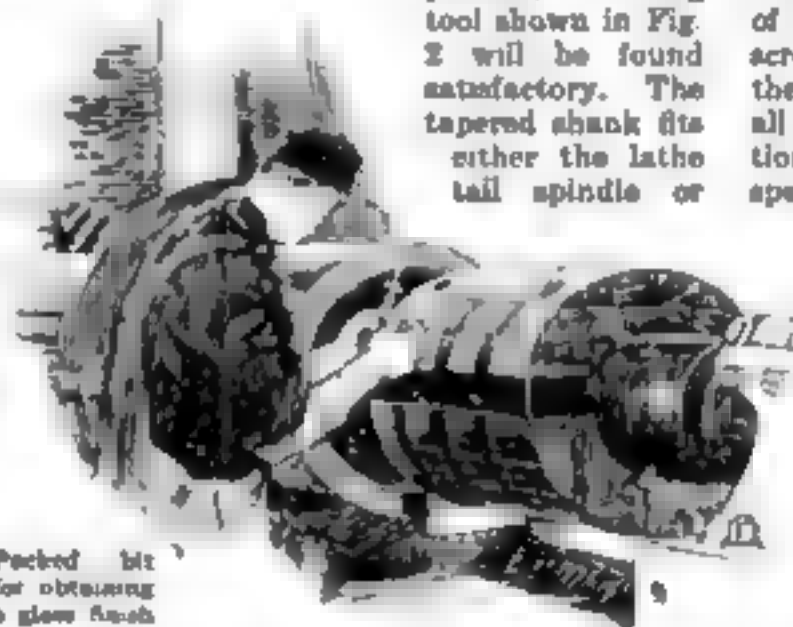
Fig. 3

Typical lathe boring tool, adjustable boring tool, and a simple double-edged cutter

By George Arthur Luers
Mechanic and Automotive Engineer

and the steadying bar allow the cutting edge permit rapid cutting and still produce a smoothly machined surface. With tools of this shape there will be no excess chatter, and scale riding will be eliminated.

Instead of holding the tool rigidly in a toolpost, it may be necessary to have it so that it can be easily adjusted. For this purpose the adjustable boring tool shown in Fig. 2 will be found satisfactory. The tapered shank fits either the lathe tail spindle or



Packed bit for obtaining a glass finish

the spindle of a vertical or horizontal boring machine. A single tool is fastened in the swivel by means of set screws, and two adjusting screws permit adjustment of the cutting edge within a limited range. This type serves as a good all-purpose tool and the method of support provides the requisite steadiness to prevent chatter

Using a Double-Edged Cutter

Where holes are deep, it is best not to attempt any boring with a single tool in a long boring bar since excess chatter is sure to result. For this purpose, a double-edged cutter will be found more satisfactory. Figure 3 shows a simple type. The tools should be set at equal distances from the center of the bar in order that the opposite cuts will have equal resistances. In this way great smoothness can be obtained.

While the long bar usually is used in a drilled hole, it will give good results even in a pipe having hard scale. Since the cutting edges are balanced, there will be no tendency to ride the scale. For this reason the edges can be ground to the usual taper of a drilling bit. The tool may be made of one or more pieces, but it must be possible to move out the tool as wear occurs. The wedge method of holding the tool in a rectangular slot is both simple and dependable, for it holds the tool firmly and allows for easy adjustment and removal of the tool for grinding.

Having decided upon either a single- or double-edged cutter, the mechanic's next consideration should be the holder. Figure 4 shows four methods in addition to the wedge method just mentioned that are considered satisfactory in making boring-tool holders.

Where additional support is needed, the upper two holders can be used to advantage. Here the tool is away from the end of the bar and the end can bear in a jig or bushing guide. The screw method shown below is applicable to cutters at the end of the boring bar, while the wedge and screw conjointly are used when finishing the extreme end of a bored recess. While all of these methods are correct, the selection of any one of them depends upon the special job that is to be done.

In all holding methods the wedges should have very slight tapers and the screws should be sufficiently large so that there will be no loosening or shifting under the cutting strain. Just a slight shift may produce an ineradicable gouge.

One of the hardest problems of the mechanic is the construction of a suitable tool for recess boring. To be successful, it must be made so that the tool can be expanded and also contracted for withdrawal.

Wedges will serve to open the tool, but they will not facilitate the closing, with the result that the tool protrudes as it is withdrawn and a gouge is made in the work.

Figure 5 shows a tool that has worked satisfactorily in recess boring. A central

(Continued on page 108)

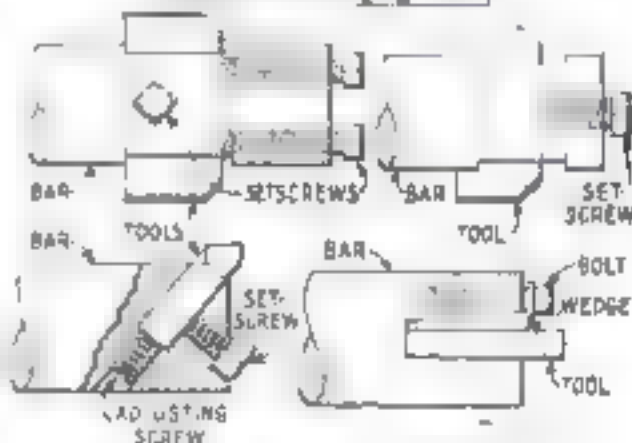


Fig. 4 Four methods of holding tools in boring bars, each having special advantages

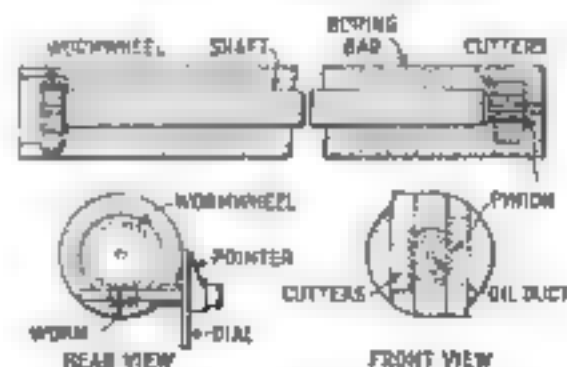


Fig. 5 One of the most successful types of adjustable boring bars for recessed work



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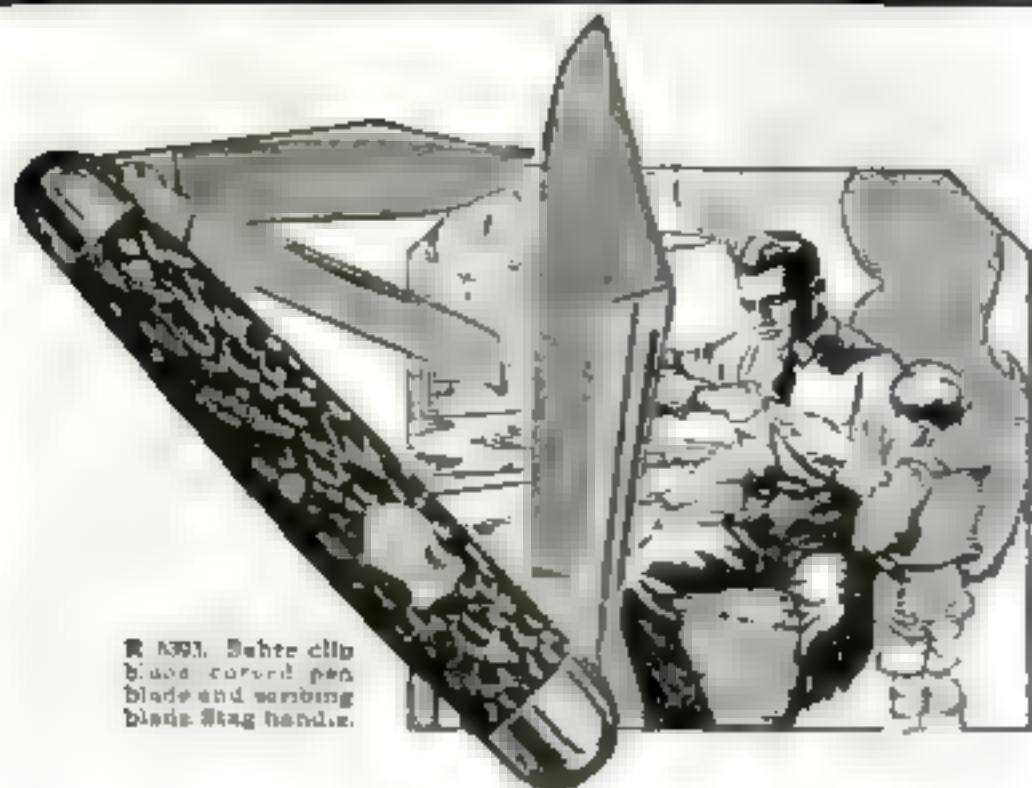
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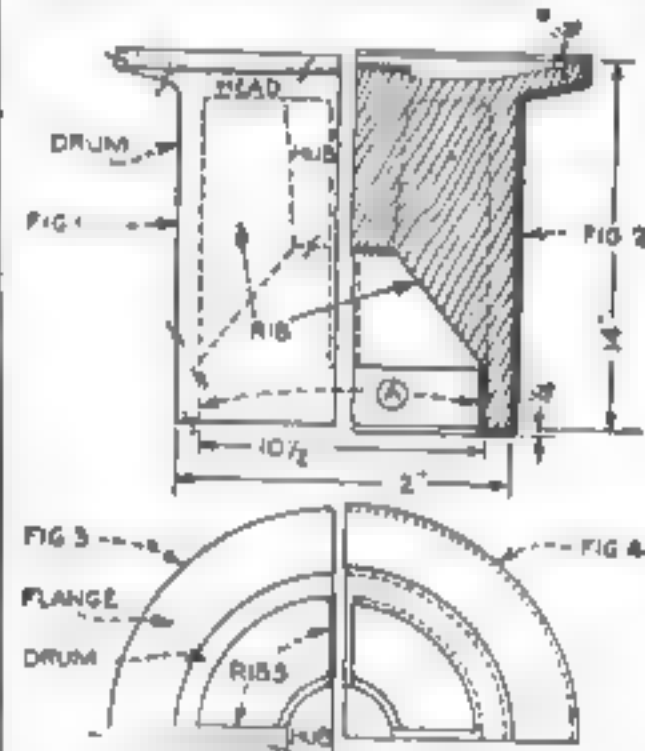
Simplifying a Rush Job in the Pattern Shop

By M. E. Duggan

What makes a mechanic successful? That really is the subject of this article by Mr. Duggan, who speaks with the authority of a man 44 years a mechanic and perhaps the best known foreman pattern-maker in the United States. In his story of a draftsman's thoughtlessness, a pattern-maker's indifference, and a foundryman's quick wit, he shows that common sense and cooperation are essential in solving the many puzzling problems that confront every mechanic.

A MECHANIC who knows his own little job will probably keep it. The man who knows how to do his job so that it will fit in well with the next man's, is the one who gets first consideration when there is a vacant foremanship. It is fatal for any mechanic to allow his own highly specialized work to absorb his interest to such an extent that he does not know what the previous man has done and what the next man is going to do.

Recently a striking and, to my mind, most interesting example of this came to my attention. A cast-iron drum had broken and the best promise that the manufacturer of the machine could offer



The finished surface at A made the pattern of this drum a puzzling problem.

for a new part was delivery in about 12 days. So the mechanical department decided to do the job in the company's own shops.

The broken casting was taken into the drafting room for a drawing to be made. With great pains, a draftsman laid out the drawing, marking all surfaces to be finished as in the original. He completed his own little job to his own satisfaction and apparently it was correct in every detail. What he did not realize was that by a single finish mark on the drawing he had given the pattern-maker a job that would tax his ingenuity to the utmost.

The original casting (Figs. 1, 2, 3, and 4) had a finished interior surface (indicated at A) extending 4 in. up from the base, and this "finish" came mighty near finishing the pattern-maker. And there was no good reason for introducing this finish, as no other part fitted into it. The

(Continued on page 90)



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Simplifying a Rush Job

(Continued from page 88)

original manufacturer naturally wished the exposed end of the drum casting to revolve true, and the draftsman had unthinkingly provided for the same finish, overlooking the fact that now the great thing was to get the drum replaced and the machine in operation again.

How often a few strokes of a pencil by an unobservant draftsman either can simplify or complicate the work of pattern-maker, core-maker, molder, and machinist. In order to simplify work, the draftsman must know general pattern-making, foundry and machine-shop practice; otherwise time, labor, and material will surely be wasted.

The blueprint was then sent to the pattern-maker. He realized immediately that he would have a ring $\frac{1}{4}$ in. thick on the interior of the drum, which, if made fast to the drum, would project into the sand and lock the pattern firmly

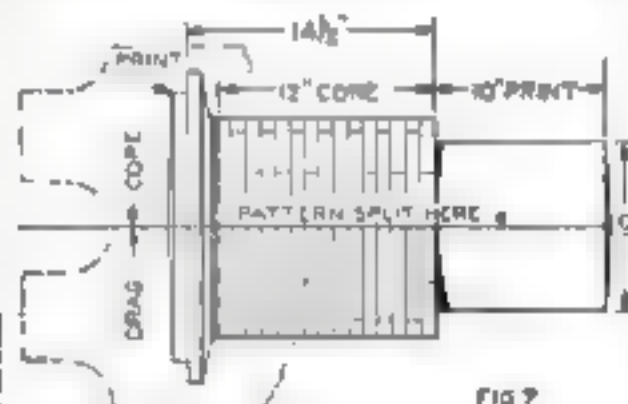


FIG 7

The pattern built in segmental courses at a cost of much unnecessary labor

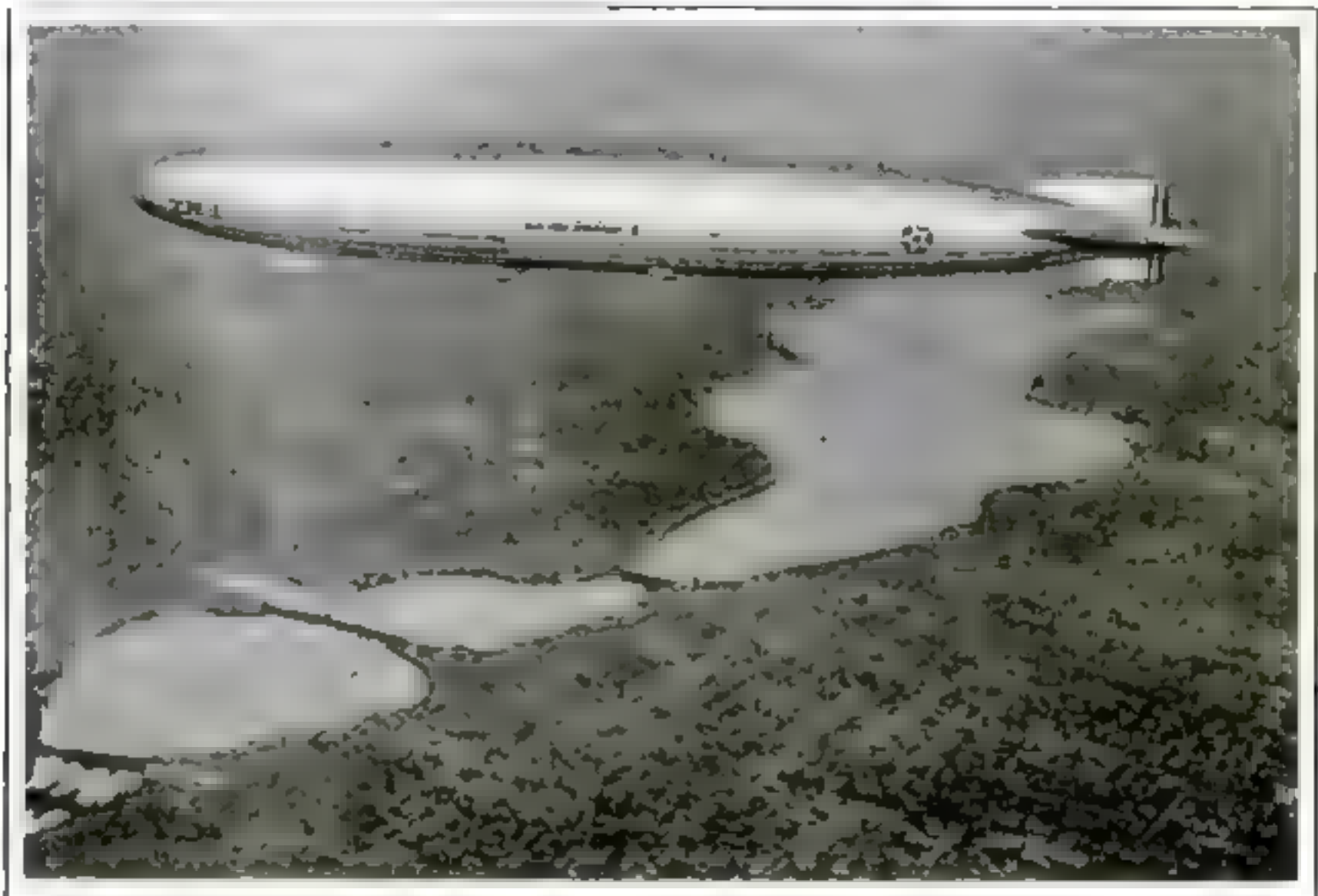
in the mold. It was too late to suggest changes in the design, for the work was wanted in a hurry. Moreover, he had learned that his job was making patterns and not telling the drafting department what to do.

After considerable study, he decided to make the ring in segments, loosely pinned to the drum pattern. The core-maker could then draw out the main part of the pattern and hook on to these segments and pull them out. The pattern was built in this way and sent to the foundry.

The core-maker shook his head when he saw the task laid out for him. In his estimation the pattern-maker should have known better than to have made the pattern in this way. It was contrary to the best molding practice. Besides, how were these little segments to be fished out of such a narrow cavity without damaging the side walls of the mold? And how were the walls to be patched if they should become torn up? He recognized it as the style of pattern-making known among foundrymen as "peeing the buck."

The pattern-maker, not altogether certain whether he had done his job correctly, was curious about this particular casting and later on inquired about it. He was shown the finished product—a fine casting with the bugbear ring nicely in place within. Evidently he had made a good guess, and he patted himself on the back. While he did not know much about foundry practice, he had prepared a difficult pattern that WORKED!

(Continued on page 92)



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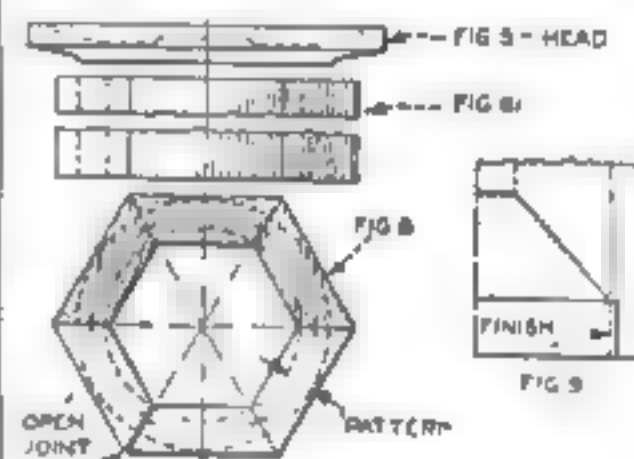
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Simplifying a Rush Job

(Continued from page 90)

But did it? Certainly not at all as the pattern-maker intended. As a matter of fact, the molder did not go fishing around for the loose segments. He placed the pattern on a bottom board, flange down. With a drag flask on the board, he shoveled molding sand in up to the top of the pattern. He next removed the dowel pins holding the segments, which were on top, and extracted the loose pieces from the mold. He placed slab cores, taken from the stock core shelves, over the circular cavity and continued filling in the sand.

The drag flask finished, the mold was rolled over and was then ready for the cope. The cope was made and lifted off, and the pattern was drawn out of the mold. There was nothing to prevent this because the segments were out of the way. The mold, drag and cope, was gated, mended in the usual manner, the cope set, and the mold closed. This was



The pattern as designed to give utmost economy both in pattern shop and foundry

practical molding practice, although the pattern-maker had not been aware of it.

It is thus seen that even though the draftsman may complicate a design and the pattern-maker may fall in line with him by guessing at molding methods, the molder sometimes can help himself by using the pattern in a way the pattern-maker had not intended. One of the greatest drawbacks for the apprentice pattern-maker in the acquisition of practical knowledge is the "distance" between the pattern shop and the foundry.

In Fig. 7 (page 90) the pattern is shown built up in segmental courses, core print at the flange end, and balance print at the opposite end. The dish in the flange as well as in the interior of the drum is molded in dry core sand. For these core sections, core boxes must be made. This is a costly pattern and is built in a way contrary to the best practical methods, but it is a method often followed by the pattern-maker who is not thoroughly posted.

Suppose we simplify the whole job, starting with the draftsman. Let it be understood that the casting is wanted in a hurry and consequently refinements of design are not to be considered. The one thing necessary is to get the casting made and the machine started.

Make the bore 10 in. in diameter instead of 10 1/4. This will provide for finishing without those annoying segment pieces. The extra metal will in no way

(Continued on page 94)



The Cold Chisel
 Vlchek "high average temper" makes it effective on a wide range of metals. A splendidly proportioned tool made of Vanadium steel of a special analysis.

The Screwdriver
 The Vlchek round shank screwdriver can not possibly turn in its handle. A series of forged lugs on the shank lock it securely into the handle without pinning. Crimped ferrule never loosens.

The Open End Wrench
 Drop forged of best steel. End jaws shaped and tempered to stand unusual strain. Bar designed for great hand comfort. A most reliable wrench.

The Ball Pein Hammer
 Guaranteed for life against chipping or breaking. Vlchek tempering produces a hard center and tough edges. Balanced to be non-tiring. Plenty of "spring" in tapered hickory handle.

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ANY tool produced by the Vlchek process is a guaranteed perfect, long-lived tool because the Vlchek process is the most advanced that the science of tool making has ever known.

Within fifteen years this institution has become recognized nationally solely through praise of Vlchek tools by mechanics, machinists and the men

who love tools that serve them uncommonly well.

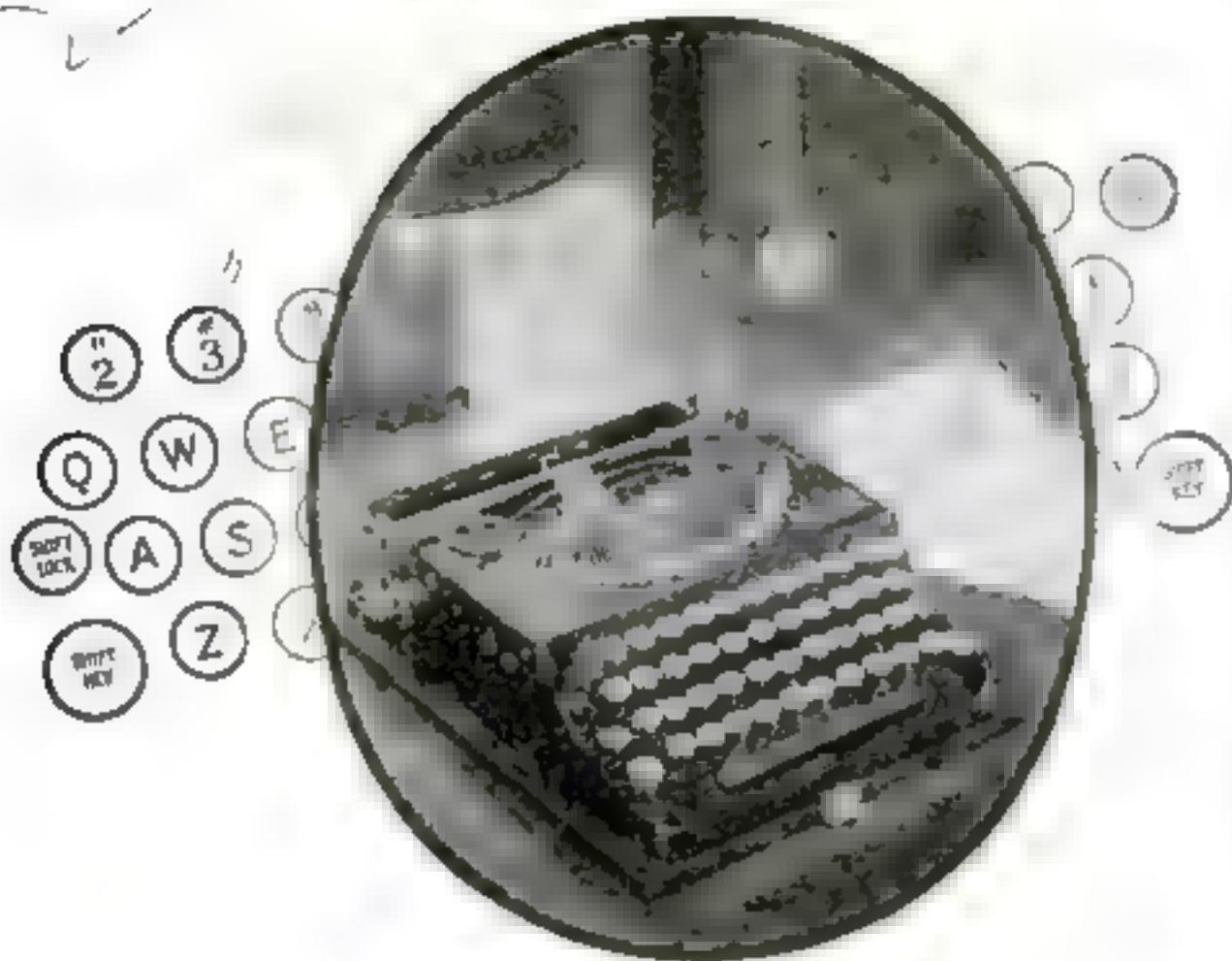
The steel, temper, design and balance of Vlchek tools—every basic fundamental—is the result of the application of exact science, infinite pains and close supervision. They are guaranteed tools although the name Vlchek on head or handle is all the guarantee a user ever requires. *Write for our catalog.*

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Simplifying a Rush Job

(Continued from page 92,

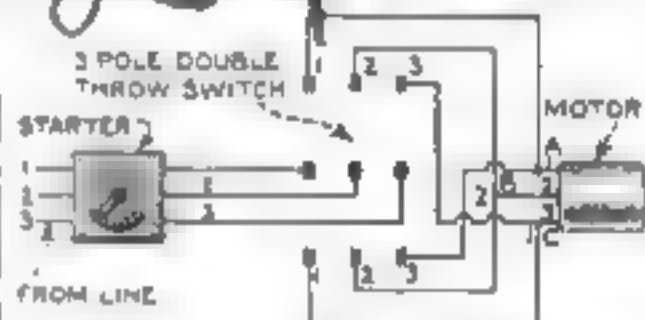
interfere with the purpose of the casting. On the contrary, it will give added strength to the drum.

In place of a built-up pattern in segmental courses, which involves increased labor, material, and time, turn the flange-head out of a single board (Fig. 6). Glue together six staves as shown in Figs 6 and 8, leaving one open joint through which a handsaw can be passed. Hold this together with a pinch dog and describe two circles to mark the outer and interior surfaces of the drum. Insert a handsaw through the opening left for it and cut along the inside circle, making a slight bevel. Then repeat the operation on the outside.

If the job has been done well, it should be necessary to add only a sandpaper finish. Next, fasten the head to the drum and coat the whole with black varnish. By passing a lighted alcohol lamp over the surface, the alcohol can be burned away, leaving a hard and dry varnished surface. In this way it becomes unnecessary to wait three or four hours for the varnish to dry. Sandpaper the pattern and it is ready for the foundry.

Reversing an Electric Motor

THERE are times when the rotation of an electric motor must be reversed. This is done by changing the direction of the current in the motor or the field. If both are inter-



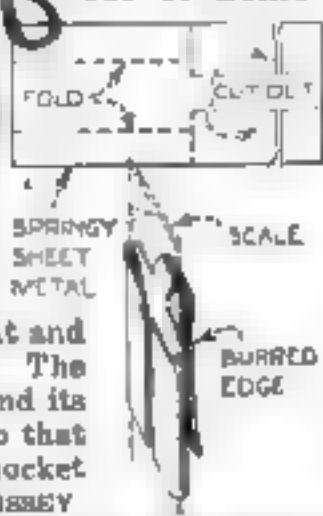
Wiring diagram showing use of three-pole, double-throw switch to change motor's rotation

changed, the motor will continue to run in the same direction.

With alternating current, interchange any two of the three wires leading from the starting box to the three-phase motor. A convenient way of doing this with a three-pole, double-throw switch is shown in the accompanying diagram. It will be noticed that while the line marked 2 remains the same, the switch provides means for interchanging lines 1 and 3.—JAMES F. HOBART, Dunedin, Fla.

Holder Prevents Loss of Scale

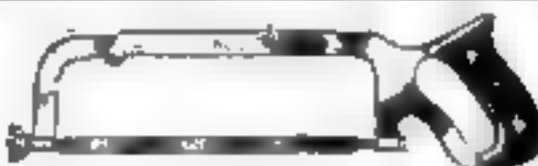
A MECHANIC can make a clip for his scale that will hold it in the same way as a clip holds a pencil. A piece of springy sheet metal about 4 in. long and 1 in. wide is cut and bent as shown. The tongue is curved and its edges are burred so that it will grip the pocket firmly. E.J. MORRISSEY





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No. 10 Hack Saw Frame

Hard rubber handle, "easy grip" pattern; hung low, thus directing force of stroke on a line with cutting edge of blade. Frame of cold rolled steel 3/16-inch thick and 3/4-inch wide. Nicked and highly polished; adjustable to 8, 9, 10, 11 and 12-inch blades.



No. 400 Hand Saw Skew Back—Ship Point

Finest saw on earth, extraordinary in quality, workmanship and finish. Genuine SILVER STEEL BLADE, 26-inch length, five gauges, taper ground. MIRROR POLISH. Solid R. S. WOOD HANDLE of the Improved Perfection Pattern. Nicked Screws. Skew or Straight Back.



No. 53 Hand Saw

Regular Pattern. A popular saw. Made of SILVER STEEL, taper ground, and given Atkins exclusive Damascus Polish. Fitted with Atkins Improved Perfection Handle, which eliminates wrist strain. Cuts fast and easy, holds edge longer. Also in Ship Point Pattern.



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This is a new saw for the Boy Scout as well as the junior and radio mechanic. A handy saw for home use. Blade 20 in. long, skew back, nine points, taper ground, highly polished, cherry handle, mission stained. Every home needs one.



No. 3 Nest of Saws

This handy set of saws includes 12-inch keyhole blade, 14-inch compass blade and 18-inch special nail-cutting blade, all interchangeable in the adjustable handle.

If your dealer hasn't the Atkins Saw you want, write us, and we will see that you are supplied.



Atkins No. 10 "Easy Grip" Hack Saw Frame shown in illustration above. Frame is adjustable to use 8 to 12 inch blades.

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PUT an Atkins Non-Breakable Blade in your hack saw frame, and you'll feel the difference at once. It will saw the toughest metal much faster and easier than ordinary blades, hold its cutting edge longer, and will not break.

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No matter what kind of a saw you require—hack saw, hand saw, compass saw, keyhole saw, cross-cut saw, circular saw, buck saw, meat saw, pruning saw, drag saw, or in fact, any saw for any wood or metal cutting purpose—there is an Atkins Saw that will do the work quicker, better and easier.

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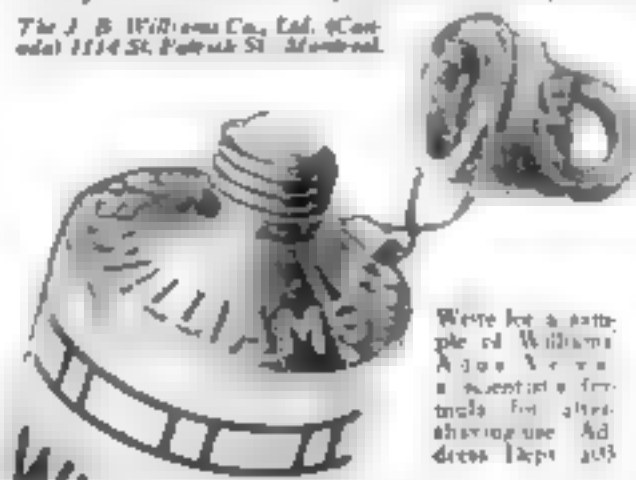
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High Speed Toolbits Retained in Holders by Shrinkage

By W. Burr Bennett

MACHINISTS generally are familiar with the use of high-speed tools of the usual 18-4-1 mixture (tungsten, vanadium, and chromium). These tools are used as a solid forged tool, are welded to a machine steel shank and held in a shank with a nutser. The welded bit is generally considered to be next best to a solid tool. In addition to its economy value, it has heat conductivity and is more rigid.



However, the majority of small shops and some large ones do not have the facilities for welding.

The accompanying illustration shows how an inserted toolbit can be made at a very

low cost with all the advantages of the welded tip and some others that the welded tip does not possess. The shank can be made of ordinary cold rolled or machine steel, but if stiffness is needed, it is better to make the shank of straight carbon tool steel.

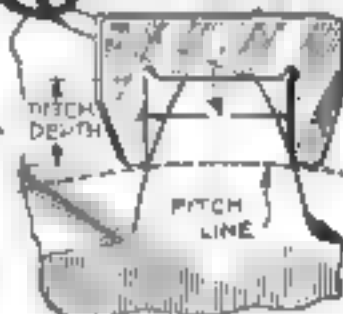
Drill and ream a round hole for the high speed bit, making the hole about .010 in. smaller than the diameter of the bit. Purchase a treated bit of the size required and see that the surface is smooth. Put the shank in the fire and heat until it is a bright red. Clamp the tail end in a vise, drive home the bit, and quench in water.

The principle involved is that of driving home the bit in the semi-plastic shank and then insuring the fit by shrinking the shank around the bit by the water quench. The suggestion that the bit be purchased ready treated is made in view of the fact that relatively few small shops have the correct equipment for correctly treating high-speed steel.

Gear-Tooth Pitch Gage

A SIMPLE and accurate gear-tooth pitch gage can be made and illustrated out of sheet metal from 1/8 to 1/2 in. in thickness. When case-hardened, it will stand hard wear.

Both the addendum pitch and the thickness of tooth can be found in handbooks or calculated and should be carefully laid out on the sheet metal. The gage is applied to find the proper depth to work the cutter.



How the gage is applied to a gear tooth

When the points of the gage just touch the tooth's flank face, the gage should rest squarely upon the tooth surface. This being true, the points are exactly on the pitch line or pitch point.

This gage may be used for either spur or bevel gears. In gaging bevel gears the gage should be applied at the extreme edge on the large end of the tooth.—H. W.

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Pitch gage gear tooth



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A Kit of Snap-On Wrenches is compact—convenient—a time saver—and because their handles are correctly designed you can easily get at all the nuts on all parts of your car.

No matter what make of car you drive your dealer can furnish a Kit of Snap-On Wrenches selected by our engineering department, especially for it. The illustration shows a typical selected Kit. There are only 11 units in this Kit, yet they can be made into combinations that will do the work of 60 old-fashioned wrenches that would weigh 80 pounds.

With a Kit of Snap-Ons in your car you can stop rattles, save repair bills, and be ready to meet road emergencies. And the cost of a Kit of Snap-On Wrenches is only a fraction of the cost of the old-fashioned wrenches needed to do the same work.

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WHEN the well-informed painter selects his varnish for work of especial importance, he chooses Neptunite. He has found that, in finishing a floor, Neptunite, with its heavy body and slow-setting quality, gives ample time for careful working. He knows that it levels perfectly, dries quickly to a hard surface, and makes a gleaming, lustrous floor that enhances the beauty of the natural wood grain, yet whose mirror-like surface reflects in subdued tones the color harmony of the room.

He knows too, that the beauty of Neptunite is a permanent beauty, resisting the wear of scuffing feet, the action of steam or mud or melting

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There are four Neptunite Varnishes—each created to do one thing well—for floors, Neptunite Floor; for exterior work, Neptunite Spar; for woodwork, Neptunite Interior and for a rubbed finish, Neptunite Rubbing.

Neptunite is carefully made, and just as carefully sold. Only one dealer—the Lowe Brothers Dealer—in your community can supply you. From him you can be assured of getting not only high quality paints and varnishes, but also sound advice as to how to use them.



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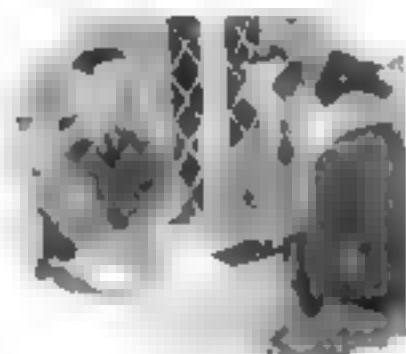
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What Is It Worth To You TO KNOW?

Many times a day you face situations that compel you to draw upon your reserve of knowledge. It may be in the office or among business associates, it may be at the club or in a social gathering. It may be in any of the activities that make up every-day life. What is it worth to you in influence and leadership, in *dollars and cents*, to meet these demands without hesitation? What is it worth to you to be the man who knows and win the admiration of your friends, the respect and confidence of your associates? Your success and satisfaction in life rest so largely upon your reserve of knowledge that you must, in your own interests, have readily available such an infallible source of knowledge as THE

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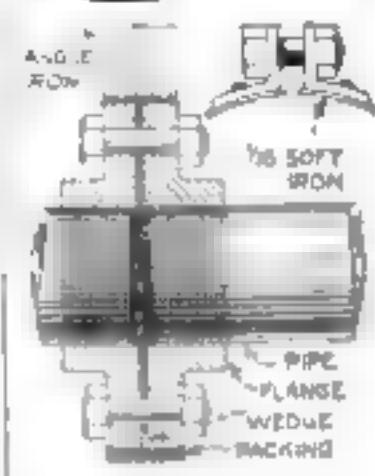
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Making Blown-Out Gasket

IT SOMETIMES happens that the gasket between two flanges in a steam line will spring a leak at a time when it is impossible to stop work and make a proper repair to the joint. In one such emergency a temporary repair was made by driving a wedge of pipe into the crack after the steam had been shut off, and cutting it off flush. A piece of rubber steam packing was placed around the flange and held tightly in place with an iron band, resembling a brake band. The band was made of 1/16-in. soft iron with a length equal to the circumference of the flanges. The lugs for drawing it tight were of 1-in. angle iron, riveted 3/4 in. from the ends and brazed. Before placing the packing, the joint was covered with pipe joint cement.



How the blown gasket was fixed

The steam was turned on and the bolt in the band followed up a little at a time until it was solid. No leak has as yet appeared.—A. S. JAMIESON, Springfield, Mass.

Fitting an Old Lathe with a New Hollow Spindle

AN OLD lathe with a solid spindle may be improved greatly by fitting it with a hollow spindle. Since small shops are usually equipped with facilities for deep drilling, the spindle cannot be made easily from a forging. It is possible, however, to construct the spindle from a piece of seamless steel tubing of a length and diameter to conform to the lathe.

The tubing is first centered and turned down for a distance of about 12 in. to



The new spindle is made of seamless steel tubing with bearing pieces shrunk on

receive the bearing pieces. The pieces for the front and back bearings (mild machine steel) are then rough turned and bored, allowing for shrinkage. After being centered, the assembled spindle is finished and the thread for the thrust collar is cut. The last operation is to cut the thread on the spindle nose and bore the taper hole.

The spindle is improved still more by fitting a set of spring draw-in chucks. In redesigning a lathe spindle the bearing should be enlarged as much as the stock design will permit.—H. L. W.

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Radio fan or not— here's a hand drill you'll like

ONLY six months old—but the biggest selling hand drill we ever made. And remember, Millers Falls trade-mark has been on fine tools for fifty years.

We designed it for radio fans particularly, but it's just as good for any man who needs to bore holes in metal or wood. Takes all drills used in radio work—handsomely finished—smooth running and sturdy.

Fills the bill for builders of radio sets and for everyone else—a tool every home ought to have. High quality at a modest price.

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Specifications:

Improved Chuck—3-jawed. Protected springs. Capacity 0- $\frac{1}{4}$ " round shank drills—suitable for all radio work. Single speed.

Ball thrust bearing. Cut gears.

Steel pinion. Solid main handle of stained hardwood.

Malleable iron frame enameled black. Large gear enameled red. Other parts nicked.

Length - - 12 $\frac{1}{4}$ in. Weight - - 1 $\frac{3}{4}$ lb.

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Radio
Hand Drill
No. 85
\$2³⁰



Look for this display box on the counter or in the case in your hardware store. It holds big value for you if you want a hand drill.



Stretching a Fifty-dollar Bill Into a \$5,000 Business

By C. J. GERHARDT

THE SECOND of last March was my birthday and made three years I'd hung on to my job at the Elite shop where I was sort of a Handy Andy around cars. I'd been working nine years in all—and had just \$50 to my name to show for it.

Last December—nine months later—my Christmas present was receipts for the last check to pay on a \$5,000 business of my own and I also had \$500 in my credit in the bank.

What woke me up was a letter I got the night I was planning a celebration of my birthday with the boys. I stood home and the gang thought I must be sick. I was sick—of the rut I was in. I wanted to get out of it, and this letter from a pal who had gone to Chicago showed me a chance. He told me how he was now a partner in an automotive electrical service station and had made good with a bang. Here



in Harrisburg he hadn't even been in the automobile game. So I was plenty interested in what that letter had to say! Here's the part that woke me up:

"It doesn't take a detective to find a broken spring or a loose clutch. The letter ran for a master mechanic to fix such things. It's the fellow who knows the big things in the shop who makes the difference. You know how a handle at a gas pump gets on. It's a simple thing, but it's a thing that can happen to it. It's in one of the other of only three classes. Certain tests tell you what's wrong. I found how I could make a difference in fifty days, and I did."

You can do it too. If you'll take five minutes to read this explanation and let it sink in, you can't see electricity and you can't take hold of it, so you have to locate a electric in the car with your head. Then you get the cause of electric trouble as simple as the flow of water and the leaks are just as easy to find. Let someone know and you can't get it out of your head and you can find what is wrong with it and have the money in your pocket while he follows who has to guess at what's wrong. What to try next! All that's needed then is a little practice with the instruments that detect and measure electric energy and you can just about pick your own employer or else do as I did and strike out for yourself."

I put in exactly fifty days getting the principles of electricity down pat and getting confidence doing practical jobs on every sort of motor and generator. I never could have dug it out of books. I doubt if I ever would have got it from watching others. My

first move after I had taken this shortcut to really know electricity and what I was in a position to do was to try my skill at home in town. I had an electric repair job in one of the biggest garages in town, at \$45 a week.

The first morning, I rolled a bus wired like a Chinese puzzle with a generator like nothing I'd ever done before and the owner had a whole lot of things that were wrong. I admit that I would have slipped out of the shop if I hadn't hung around in the boss's office. But I figured I'd stay there until I was sure I could do the things he wanted me to do. At an occasion I was called and he said, "You're on. So I put all my best test, took the readings. I'd learned to make for classifying the trouble whatever it was—and it worked."

I had the difficulty nailed inside of 3000 an hour and by noon I had that car all right. When the owner told me he had had his car to two other places that had been stumped on that job, it made me feel pretty good.

I put in about a month when I got raised to \$50 a week while at making \$45.

The next day after the delivery superintendent of the store that sent all the parts out to me put it in my head to start up for myself. He got me the use of an old back of the company and I soon had enough other work to keep me and my others busy. In almost two weeks I had paid down a thousand dollars to my building and we put in a new floor and some benches and other conveniences. I guess I must have nearly a thousand dollars worth of tools and instruments now. The thing is, though I don't have many but need as many as I'm breathing.

As I have said the business is all mine now and all paid for and I draw \$5 a week for myself from the day I opened up shop.

I haven't told all this to brag about myself or how smart I am, but a fellow it would be a help to someone who may be like I was hardly over six months ago—dubbing along in the dirt and grease and huffing myself I was in the automotive business. Now I want to give you a hint where the most of it is done—the instruction and pointers principles of electricity in my head in such a way I could use them and turn them into cash. It was the Ambu Engineering Institute in Chicago that gave me my start. So far as I know it is the only place in the country where all motor electricity has been reduced to such simple terms that any fellow who can't master it is a simple task. It is so easy that even the little book they send you free will prove the whole proposition to you in half an hour. And I am glad that I sent for it!

first move after I had taken this shortcut to really know electricity and what I was in a position to do was to try my skill at home in town. I had an electric repair job in one of the biggest garages in town, at \$45 a week.

The first morning, I rolled a bus wired like a Chinese puzzle with a generator like nothing I'd ever done before and the owner had a whole lot of things that were wrong. I admit that I would have slipped out of the shop if I hadn't hung around in the boss's office. But I figured I'd stay there until I was sure I could do the things he wanted me to do. At an occasion I was called and he said, "You're on. So I put all my best test, took the readings. I'd learned to make for classifying the trouble whatever it was—and it worked."

I had the difficulty nailed inside of 3000 an hour and by noon I had that car all right. When the owner told me he had had his car to two other places that had been stumped on that job, it made me feel pretty good.

I put in about a month when I got raised to \$50 a week while at making \$45.

The next day after the delivery superintendent of the store that sent all the parts out to me put it in my head to start up for myself. He got me the use of an old back of the company and I soon had enough other work to keep me and my others busy. In almost two weeks I had paid down a thousand dollars to my building and we put in a new floor and some benches and other conveniences. I guess I must have nearly a thousand dollars worth of tools and instruments now. The thing is, though I don't have many but need as many as I'm breathing.

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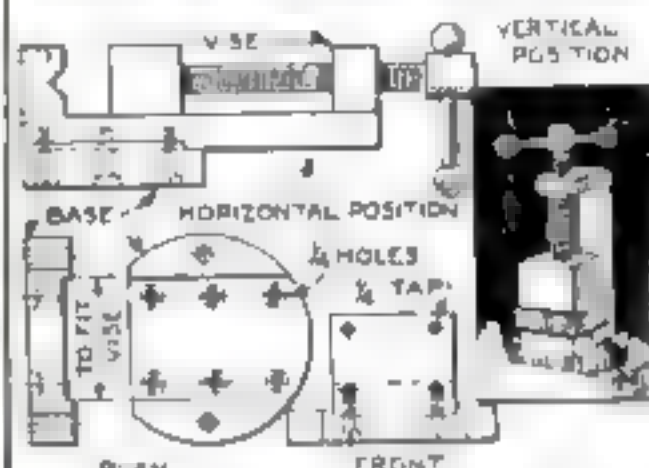
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Base Adapts Small Tool Vise for Machine Use

WHEN fitted with a base, a small machine vise of the ordinary variety designed for holding small parts for drilling can be used to good advantage on hand millers, grinders and other machine tools.

To make such a base, turn a disk of cast iron to suitable diameter, face it on one side and cut a groove in a shaper through



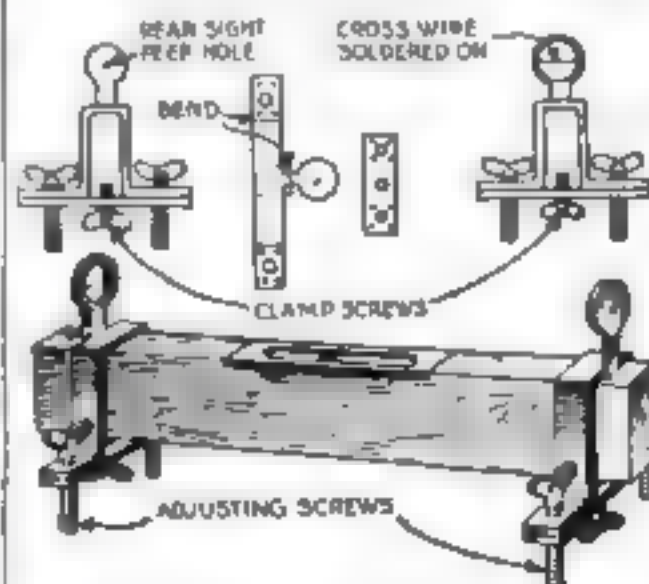
The vise is fastened either horizontally or vertically to a special cast-iron base.

the center to the depth of $\frac{1}{2}$ in. and exactly as wide as the vise. The base is then drilled for two hold-down bolts, either $\frac{3}{8}$ or $\frac{1}{2}$ in. Small holes are also drilled and counterbored as shown for the screws that fasten the vise to the base, either in a horizontal or vertical position.

Facing off the base so that it will be flush with the top of the vise, when the vise is in the vertical position, allows the work to be clamped close to the forward edge of the worktable. That is often a great advantage for end milling with short cutters.—V. R.

Sights Adapt Carpenter's Level for Grading and Fencing

A BUILDER'S level or a surveyor's transit is not always available when fences, walls, farming or grading operations are to be laid out. An ordinary carpenter's level may be made an effective substitute in all sorts of such lining-up jobs. Two sights to fit the level are purchased or made, one with a peephole of about

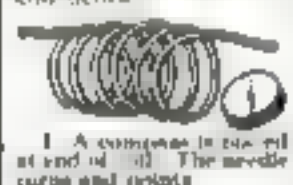


How the front and rear sights are attached to a wooden or metal level.

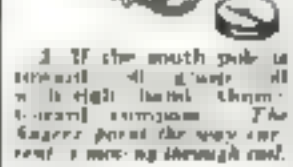
$\frac{1}{16}$ in. diameter and the other with a larger hole that has a horizontal length of thin wire soldered across it. The two side screws on each sight are used to level up the instrument upon any convenient and relatively flat surface.—G. L.

Can YOU Think Electrically?

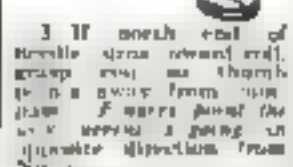
This 5-Minute Test will tell if your mind can be made to think out and use electricity. Suppose you had a know which way the current is going in a coil below.



1. A compass is placed at end of coil. The needle turns and points.



2. If the north pole is toward all wires of a high hand, thumb toward compass. The fingers point the way current is moving through coil.



3. If north end of needle spins around coil, grasp coil as though it is a wire from your hand. Fingers point the way current is going in opposite direction from No. 1.

IF ABOVE IS CLEAR TO YOU, then you can find out most of electric principles. It is all up to you and your own mind. You are waiting for your chance to know it.

ally and you can find what is wrong with it and have the money in your pocket while he follows who has to guess at what's wrong. What to try next! All that's needed then is a little practice with the instruments that detect and measure electric energy and you can just about pick your own employer or else do as I did and strike out for yourself.

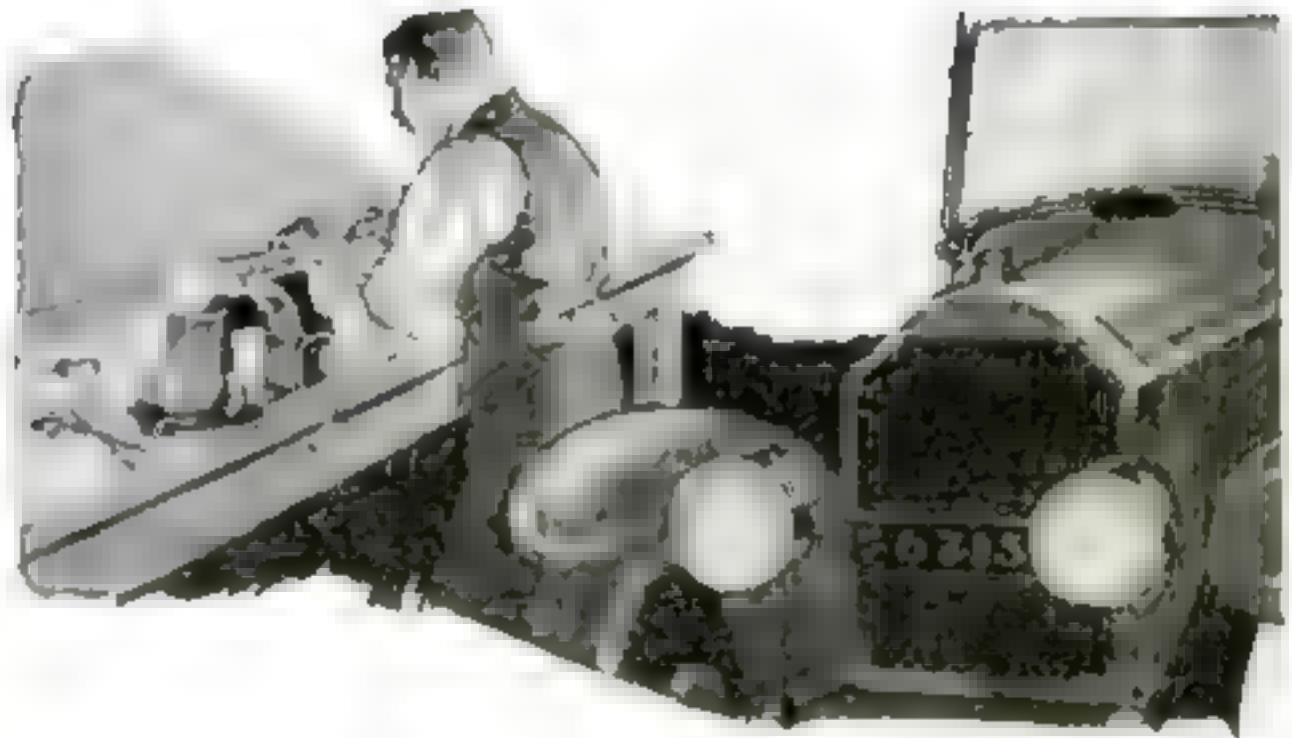
I put in exactly fifty days getting the principles of electricity down pat and getting confidence doing practical jobs on every sort of motor and generator. I never could have dug it out of books. I doubt if I ever would have got it from watching others. My

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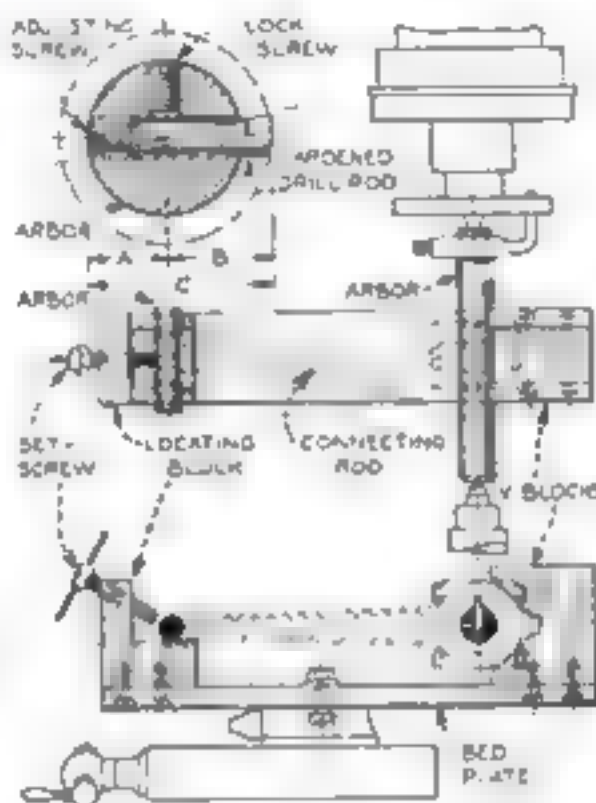
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Fixture Simplifies Reaming of Rebabitted Connecting Rods

AUTOMOTIVE repairmen more or less often are confronted with the job of reabbaiting and reaming or boring out the crankshaft end of connecting rods. While fixtures for this work are on the market, small shops can do the job well with a simple device that can be altered to the cross-size of a lathe.

Two V-blocks are fastened to one end of a lathe plate and a rotating block, with sides accurately parallel, is attached at the other end. A set screw in the block serves to force the wristpin end of a connecting rod down between its parallel sides as well as pressing the crankshaft



Top and side views of the connecting-rod fixture and details of boring rod and tool.

end into the V-blocks. A small arbor in the wristpin hole bears on the parallels and keeps the axis of the hole to be reamed horizontal, while the arbor with the cutting tool, which is carried between the lathe centers, keeps the axis correct in the vertical plane.

Referring to the accompanying cross section of the arbor, the distance *B* represents the radius of the finished hole and *A* is the radius of the arbor. If the tool is set accurately by means of micrometers, and has a broad, smooth edge, there will be no necessity for scraping after the finishing cut has been taken.

In babbitting such a job, only metal with a tin and not a cheap lead base should be used. While an 80 per cent tin alloy will require a very hot ladle and rod to pour, the results will well repay the effort. Pour the babbit on an arbor about $\frac{1}{4}$ in. smaller in diameter than the finished bore. After it has cooled, take the cap from the rod and carefullypeen each half, making sure not to peen too deeply. Then bolt the cap to the rod, and the job is ready for this fixture.

AN EXCELLENT leather cement can be made of equal parts of good hide glue and American isinglass, softened in water for 10 hours and then boiled with pure tannin until the whole mass is sticky. The surface of the joint should be roughened and the cement applied hot.

Cement, leather

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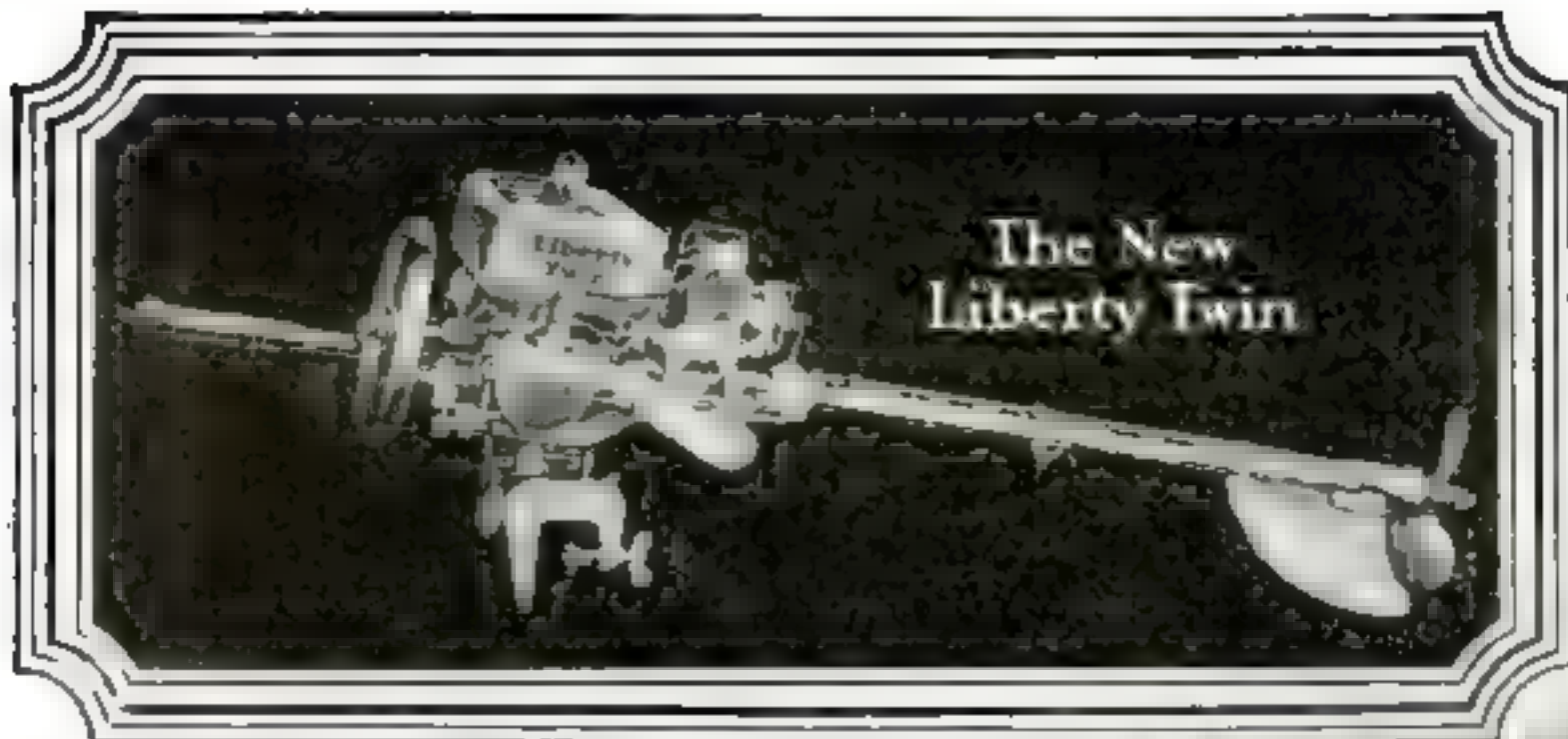
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Perfectly
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View below shows how the propeller can be locked up out of water if desired.

The Speedy, Light Weight, Non-Vibrating Liberty Twin

Bosch Ignition—Zenith Carburetor—Direct Drive

Now—a rowboat motor that leaves nothing to be desired—that will take you anywhere and back, regardless of weeds, of shallows, of hidden obstructions—of anything but an empty gasoline tank. It has twin cylinders, eliminating vibration. It is light in weight and easily carried. It is of the direct drive type, has no bevel gears—wastes no power. The propeller extends straight out from the stern of the boat and seeks its own level in the water. Merely touching a hidden obstruction causes it to rise and pass over. Other so-called "tilting" motors require a blow of 60 to 70 pounds to cause them to tilt. Such a blow ruins a propeller. The



is the higher and more refined development of the direct drive principle which has proven its correctness over a period of years. It is not new and untried. This principle, combined with twin cylinders, light weight, compactness and

Bosch Ignition

provides a motor unsurpassed by any on the market. It is the only rowboat motor equipped with the Bosch Rocking Type Magneto which was designed by the combined Caille and Bosch engineering staffs. It delivers a uniform hot spark at any speed. Should you ever require ignition service you can secure it from any of the 2,100 Bosch Service Stations throughout America. Flywheel type magnetos can only be serviced from the factory. This means long delays and sacrifice of the motor's use—often when you want it most.

Motorcycle Control

Simply twisting the grip on the steering handle changes the speed. No tuning lever to bother with. The hand that steers controls the speed.

Zenith Carburetor

A specially designed model for the Caille Liberty Twin. Operates automatically at all speeds without any adjustment whatever.

Light Weight

Propeller shaft is instantly detached and telescopes to a convenient length. Motor has convenient carrying handle and is beautifully finished throughout.

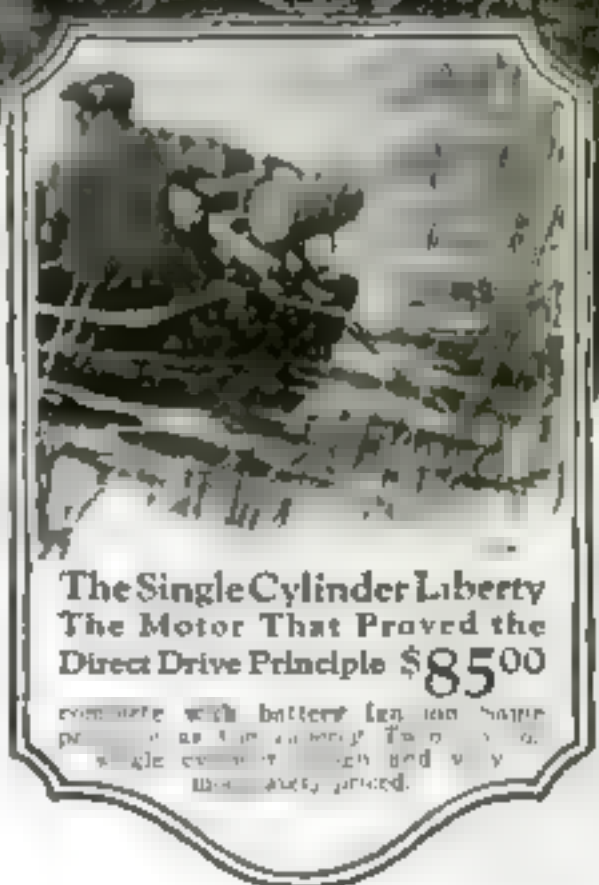
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Rowboat Motors



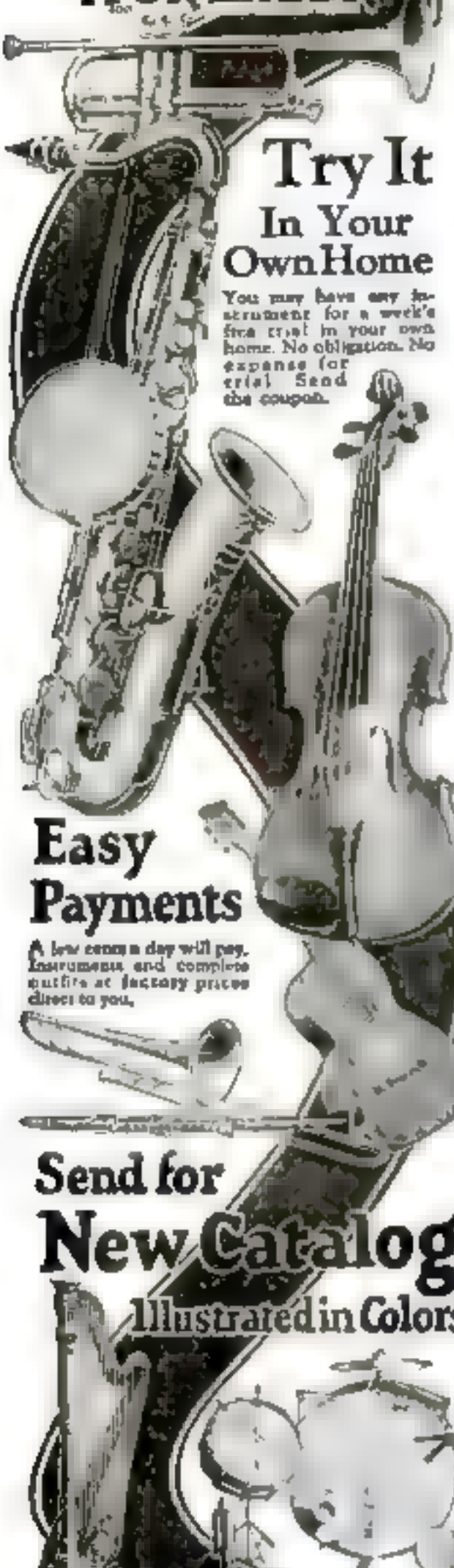
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The Motor That Proved the
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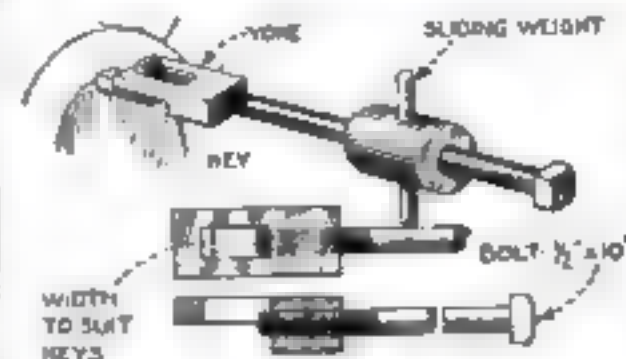
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Stubborn Keys Drawn by Means of Hammer-Like Puller

IT IS often difficult to remove stubborn keys without damaging the heads, for the reason that they have been driven home hard with a hammer. A simple form of key puller that will accomplish this is made as follows:

A block of medium-weight steel is shaped as shown, then squared to fit loosely over



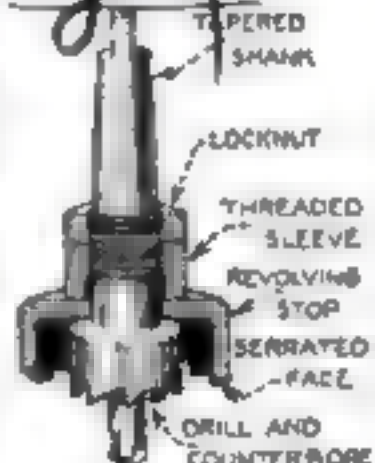
This type of machine-key puller will not damage the heads of firmly fixed keys.

the head of the key. The rear of the block is left thick and heavy and is tapped for a $\frac{1}{2}$ -in. bolt about 10 in. long. A weight is made to slide freely over this bolt. This weight either can be knurled or have two handles fitted to it. The yoke member of the puller should be case-hardened to increase its strength.

When the weight is pulled back against the head of the bolt, a hammer action is produced that soon loosens the key.

Serrated Depth Stop for Drilling and Spot Facing

STOPPING of a drill or planer or other tool, when drilling the holes, can be done effectively with the tool illustrated. The loose revolving stop with a serrated face enables the drill-press operator



Used with combination drill and counterbore.

to control the depth and still overcome scraping or side strain difficulties that would be caused by using an ordinary depth gage.

The drill and counterbore is made as usual, while the stop arrangement is a sleeve fitted about the shank with adjustable threaded collars above it.

FEATURES FOR APRIL

"INGENIOUS Work-Holding Fixtures," by F. J. Wilhelm, will appear in the Better Shop Methods Department next month.

W. Burr Bennett will describe a simple nut tapping fixture; Frank N. Cookley will give details of a homemade valve grinder for the garage man; Donald A. Price will give a design for an eccentric foundry flask clamp; and George A. Luers will explain a new one-piece tool for refitting engine valves.

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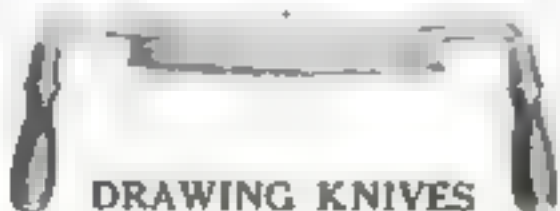
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All Practical Sizes



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He'll have it planed *in a jiffy!*

IN THIS home workshop radio is king. In fact, a goodly number of big and little sets, comparable to expensive commercial types, have gone from this bench into neighboring homes. This young man has a reputation for good workmanship. He takes particular pride in his ability to choose and use good tools.

Once you have used the handy little Sargent Steel Block Plane, no other finishing plane will do. It is great for work in close quarters, for smoothing up panels, bureau drawers that have been sticking, and similar things. It is as true and clean cutting and as finely made as the larger Sargent Auto-Set Bench Plane shown above.

The Auto-Set, of course, should be in every workshop for use on the bigger jobs. It is light in weight and remarkably easy to adjust or sharpen. The chromium steel cutter may be removed, honed and replaced without changing the original adjustment. Yet it is so firmly held in place that it never chatters, even when cutting across the grain or over rough and knotty surfaces. You will find the Sargent Auto-Set Plane an aid to speed and accuracy.

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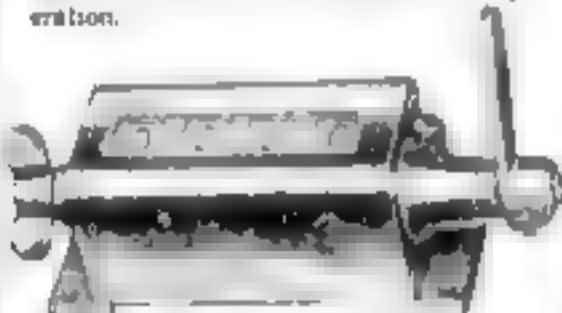
—when each turn of a shaft records a piece of work, or an operation of your machine.

If you are the operator, you want a good production-record, personally. If you're the inventor you want a good showing *mechanically*.

In either case, you gauge your actions by this: What does it add to the **OUTPUT?**—as indicated on the

Veeder COUNTER

The Revolution Set-Back Counter below records the output of any machine where a shaft-revolution indicates an operation.



Set back to zero from any figure by turning knob once round. Supplied with from four to ten figure wheels, as required. Price with four figure-wheels, as illustrated, \$0.00—subject to discount. Cut has them one-half size. Set-Back Rotary Ratchet Counter, to record reciprocating movements as on presses, \$11.50 (list). Smaller counters from \$2.00 up.

The Hand Tally illustrated below is used for counting anything from number of people attending a ball game, to number of packages in an inventory, in the public place (1 counts persons; in the factory or store it counts stock; in the "open" it may count anything from cattle on a ranch, to poles on a telephone line). Registers one for each pressure of the thumb lever; counts up to 10,000, then repeats. Can be set back to zero from any figure by turning knob once round. Size, exclusive of finger ring, 2 inches greatest diameter. Price, \$5.00.



Write us about that counting problem of yours—it's probably answered in the 80-page Veeder booklet, copy free

The Veeder Mfg. Co.,
44 Sargeant St., Hartford, Conn.

Speedy and Accurate Boring

(Continued from page 108)

the holder and turned on the lathe, to a diameter of two or three hundredths of an inch larger than the bore to be finished.

As the tool enters the work, the hardwood packing on the head follows, supporting the tools from every side and preventing any possible chatter. A continuous flow of oil must precede the cutters so as to wash away all chips. A few chips are bound to get by, but these do no damage, since they become embedded in the wood. This is the most serviceable of all tools for securing a smooth bore.

An important element to be taken into consideration with all boring is proper lubrication. Machine oil or some equally good fluid lubricant should be used unsparingly, for it decreases the friction, prevents gouging caused by chips and avoids galling of the boring bar and other moving parts. Oil carries off the heat produced by the cutters as well as removing the chips.

Feeding Oil to the Cutters

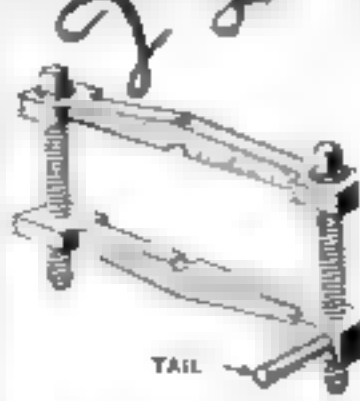
Methods for getting oil to the cutters vary. In some cases oil is fed through a hole running the length of the bar. A pump forces the oil into this tube through a flexible hose; the oil runs out at the other end and is caught in a screened pan and brought back to the pump for recirculation. Where a pump is not available, an elevated reservoir can be used to feed the oil. All oil should be screened before being returned to the reservoir. Figure 7 shows a method giving continuous oil supply.

Where entrance is to be had at the end of the work opposite the bar, a small copper or brass pipe can be inserted through which oil can be run from an elevated reservoir. In some instances this method cannot be employed. The open end is then blocked with a disk fitted with a central hole for housing a loose extension from the bottom of the oil container. The oil is thus blocked against running out at the end of the tube and flows back past the cutters and out at the boring bar end of the work.

If you use the proper tools, have these in the best condition, lubricate all work well and adhere to approved practices, you will not be likely to suffer the experience of Joseph Dyson.

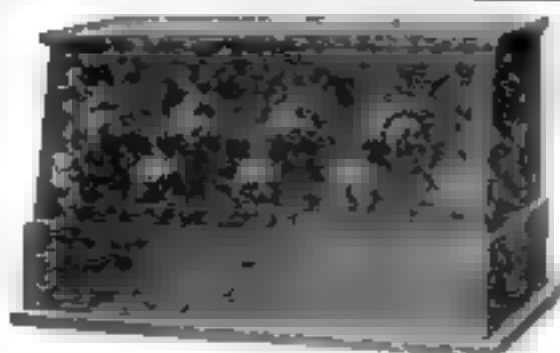
Universal Lathe Dog

THIS lathe dog will grip any work of a large range of diameters. Two pieces of 3/4-in. square steel about 3 in. long are shaped as in the figure, with the center left wider to add strength where the piece is grooved. One piece is drilled and the other is tapped to receive 5/16 in.



Has wide adaptability

18 thd. machine screws. A 3/4-in. stud is screwed and riveted in place to serve as a tail. C. A. P.



MAKE MONEY—SELL RADIO!

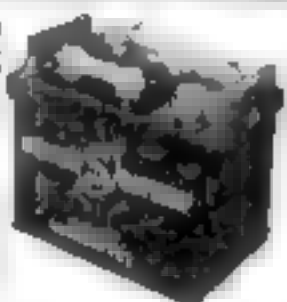
Radio offers the biggest money-making opportunity on earth today. And the Ozarka Plan opens the door to this big opportunity. Look at the picture of this beautiful Radio Receiver. This picture was made from an actual photograph. By the Ozarka Plan this Radio Instrument can be the product of your own making—easily, simply and surely. It will be yours to make to sell and to reap a rich reward in cash profits.

No experience necessary. You need not have much cash. All you need is spare time, determination and action. If you're that kind of a chap, the Ozarka Plan will start you on a straight line toward a real money-making business of your own. It can be as big and as profitable as you are ambitious to make it. We want good men in every county. Receive territory in going fast. Be sure and give us the name of your county. Write today for the Ozarka Plan. A wonderfully interesting book of facts, particulars and proofs. It is FREE. Act now.

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SAVE 50% ON AMBELL CASE UNLEAKABLE RADIO BATTERIES

HERE is the lowest price and biggest guarantee in Radio Batteries today. This is the type of specially designed Radio Battery at the wholesale price. Indestructible. Won't leak, leak, or burn up. No danger of explosion. You are fully protected by our trademark 2 year or conditioned guarantee.



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You get a new battery if your Silver-S is non-functional for any reason.

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SEND NO MONEY. Your battery shipped C.O.D. if you prefer. Money refunded if it is defective. You can return it for a new one. No questions asked. (Just the principle you are protected—what you save is your own.)

Order today. 5% discount for cash with order.
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1226 Michigan Ave. Dept. PE Chicago, Ill.

UNCONDITIONAL 2-YEAR GUARANTEE

Six Machines in One

Combines bench saw, sander, drill, grinder, polisher, and buffer for working in wood and soft metals.

Boice Pony Bench Machine

A precision machine especially adapted to rough and accurate work. Handles 4" and 5" grinding wheels, 6" saws, 6" and 8" sand discs and 1/2" chuck. Saws 1 1/2" wood. Mounts on separate base with motor. Height 10". Weight 11 lbs. up to 10" x 12" easily removed. 3" metal construction. Family drive of 1/2" or 1 1/2" motor. Specially built for Private Shops, Laundries, Barbering Depots, Printers, and Pattern Makers. Pump and Repair, etc. Machine sold with a money-back guarantee.



Write for descriptive literature and prices at Boice Pony Bench Machine and the above Boice-Bench Machine and Motor.
W. B. & J. E. Boice 1724 Maryland Ave. Toledo, Ohio



Profit by His Experience

Let the seasoned experience of a veteran guide your selection of tools.

Most Master Mechanics endorse NICHOLSON Files because they have always used them. They know that perfection of finish is impossible with cheaper, lower-grade files. That because of ready-sharpness, finer temper, greater uniformity and endurance, NICHOLSON Files save precious time and expensive materials in their shops.

Let the other fellow get the experience—and profit by it whenever you can.

Every good Hardware Dealer carries a complete assortment of NICHOLSON Files and rasps. And most dealers are competent to advise you as to the sizes, shapes and cuts you need.

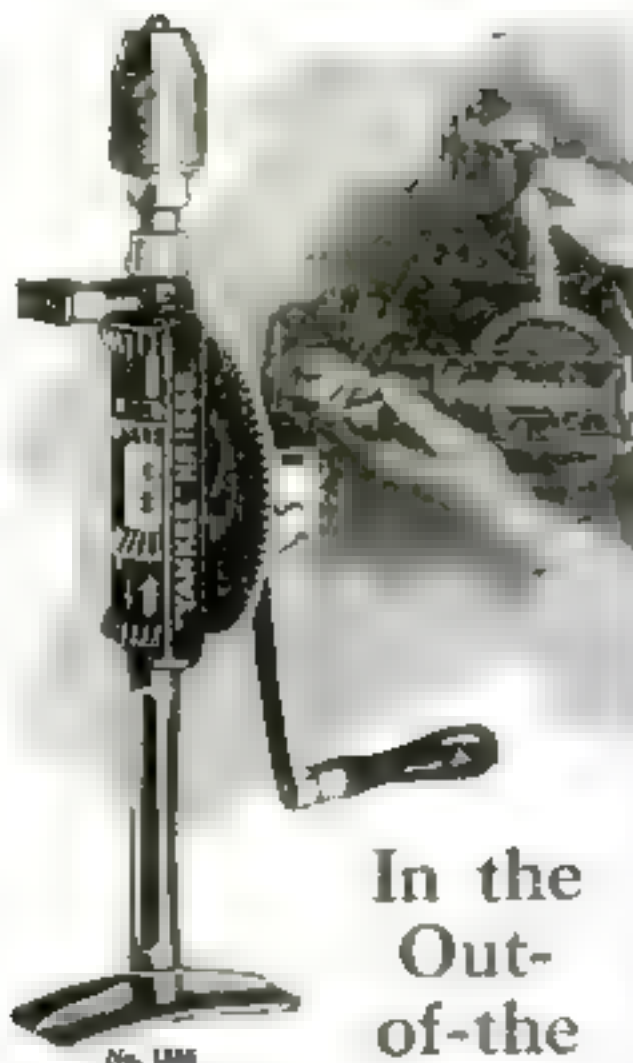
NICHOLSON FILE CO.

Providence, R. I., U. S. A.



NICHOLSON FILES

~ a File for Every Purpose



In the
Out-of-the
way
Places

Where you are cramped for working space, the "Yankee" Ratchet Breast Drill saves time and labor. The

"YANKEE" Ratchet Breast Drill No. 1555

Illustrated above, cuts continuously when the crank is moved only an inch either way. The "Yankee" Double Ratchet makes this possible. Fingertouch changes adjustment to Right- or Left-hand Ratchet. Plain Drill or gears locked. Two speeds, changeable without removing drill from work.

Some other "YANKEE" Tools

Ratchet Screw-drivers Ratchet Hand Drills
Ratchet Screw-drivers Chain Drills
Automatic Drills Bench Drills

Dealers Everywhere Sell
"YANKEE" Tools

TOOL BOOK Mailed Free

Illustrates and describes all the clever "Yankees" time and labor saving tools.

North Bros. Mfg. Co.,
Philadelphia, U. S. A.

**"YANKEE"
TOOLS**
Make Better Mechanics

Simply Made Combination Bench Saw Saves Handwork in Small Shops

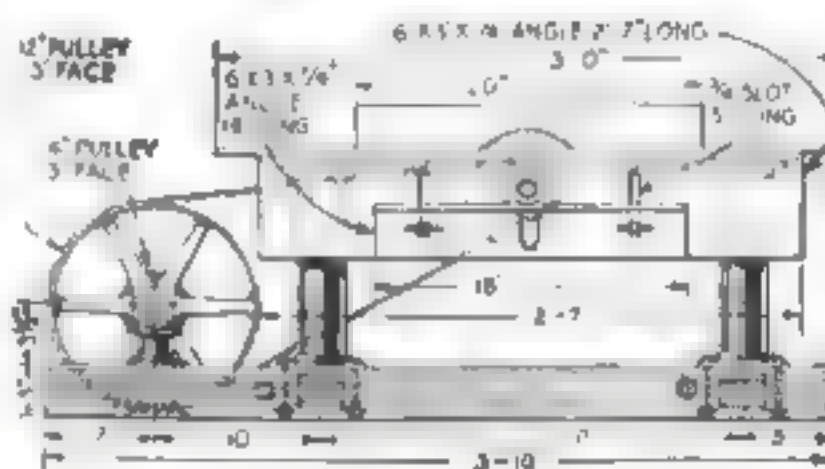
By Frank N. Coakley

THIS combination bench saw, boring and molding machine is one of the most useful machines for the home workshop or any small workshop in which standard woodworking machines are not available.

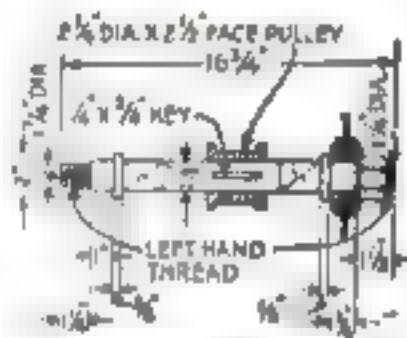
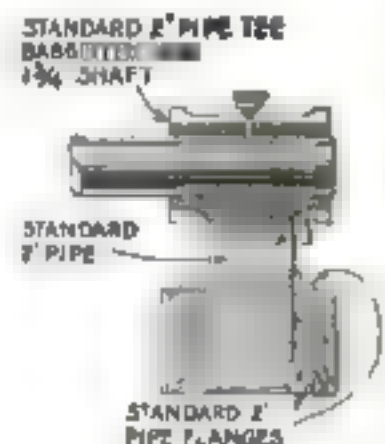
The top plate is a piece of $\frac{1}{2}$ -in. plate 19 in. wide and 3 ft. long, with a slot cut in it 6 in. wider than the saw to allow the

mandrel. This allows a cutter head to be used to make moldings, the cutting head being under the table angle. When boring a hole, the table is lowered to the position shown and a standard chuck used to hold the bit.

Standard 2 $\frac{1}{2}$ -in. pipe is used to form the supports. These are fastened to oval floor flanges, which are securely



The completed saw driven by a motor beneath the bench the side and end views showing adjustable table for boring and molding, and details of the mandrel and countershaft bearings



saw to be removed from the mandrel for sharpening or replacing. This slot should be made about 18 in. long and a piece of quartered oak placed in it, the wood being held with bolts to two flat pieces under the table.

The mandrel, which is fully detailed, is securely held in place by two bearings of any standard commercial design. All the parts that are fastened to the top plate are held by countersunk bolts. The top plate, of course, must be well finished and perfectly smooth. The gage plate or guide angle is held in place by two $\frac{1}{4}$ -in. tightening screws, which are allowed to slide in two slots in the top plate.

A 3 by 6 by $\frac{1}{4}$ in. angle is fastened to the under side of the top plate. This angle is provided with a 3-in. hole in proper location to allow the end of the mandrel to pass through, and it also is slotted so that the table for the boring and molding side of the machine may be lowered or raised as necessary. The table angle is slotted so as to pass the

bolted to two pine or oak pieces 8 by 5 in. by 3 ft. 10 in. long. These wooden pieces are connected by two cross members, as indicated.

The saw mandrel is driven by a countershaft, which is made and held in place as shown in the detail in the upper right-hand corner of the accompanying illustration. 2-in. standard cast-iron trees being babbitted to form the bearings. A 2-in. belt is used to drive the saw from the countershaft. The saw, which is 7 in. in diameter, should be run at between 1500 and 1800 revolutions a minute.

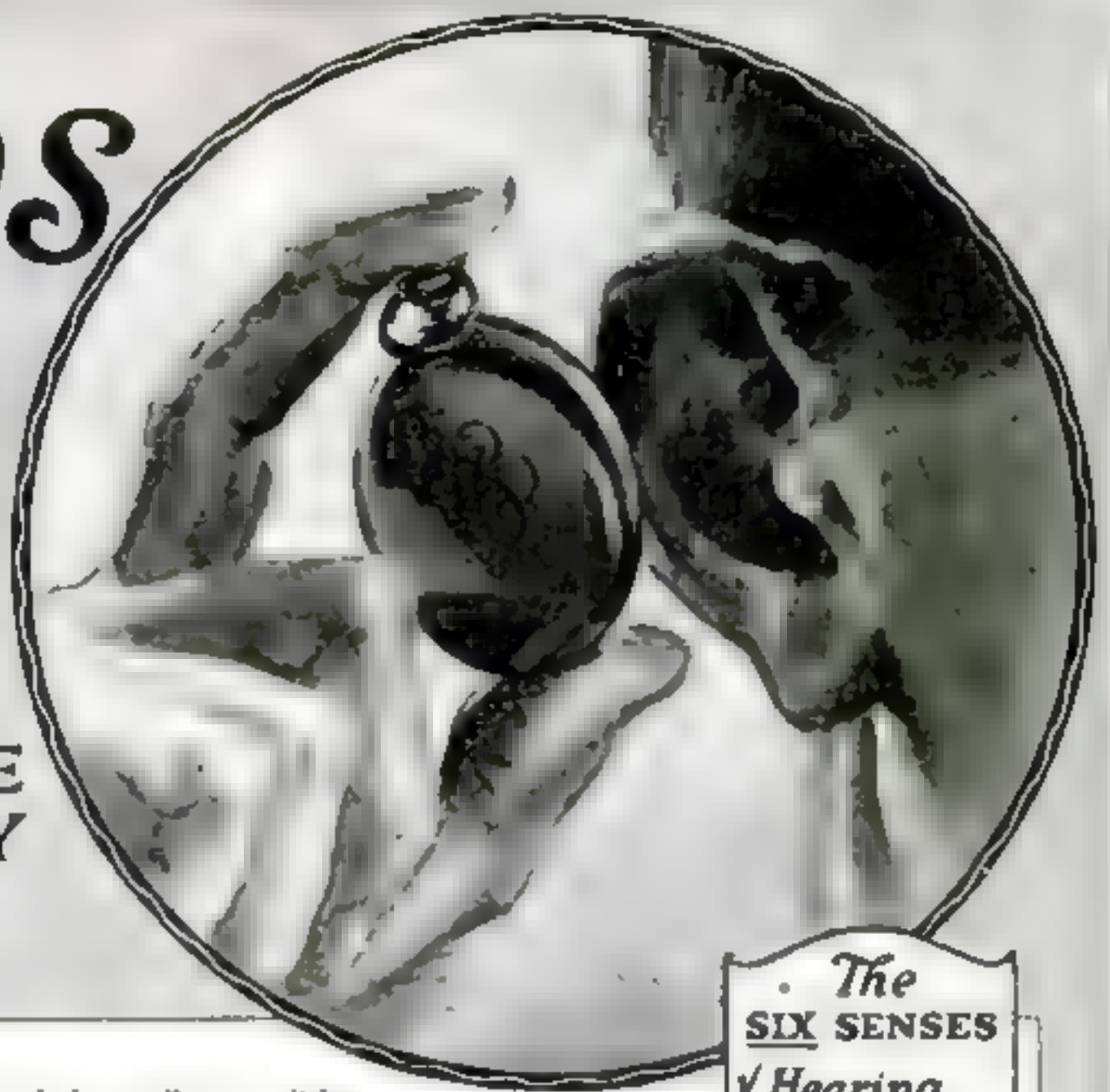
Hub Cap Provides Emergency Grease for the Car

OWNERS of cars should remember when a bearing on the car runs dry, due to lack of grease in a grease-cup, that the hub-caps of the front wheels carry an excess of grease with which these dry bearings can be lubricated, and this is better than running without grease.

Tycos

Temperature Control

THE SIXTH SENSE OF INDUSTRY



EVERY tick of your watch is a tribute to "the sixth sense of industry."

In the manufacturing of fine watches, whether the handsomely engraved case or the delicate hair-spring, heat is used. And whenever heat is used in a manufacturing process, Tycos Temperature Instruments supply that "sixth sense" necessary to absolute uniformity of products that are manufactured on a big production basis.

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Tycos Engineers have effected substantial economy for manufacturers in every line of industry by applying the Tycos sixth sense. Whatever your problem in the indicating, recording or controlling of heat there is a Tycos Instrument to serve you. Write us for literature on any instrument or type of instrument and it will be sent promptly. Or if you prefer, our engineers will consult with you on the application of the Tycos Sixth Sense in your plant.

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Tycos *Cooking Thermometer*
An accurate measuring instrument
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Tycos *Hot Water*
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For accurate measurement of
hot liquid temperature.

Tycos *Oil*
Thermometer for accurate
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Thermometer for accurate
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Seeing
Feeling
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and
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Temperature
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Uncle Bill or School-boy Bob

Whether for Uncle Bill's automobile or School-boy Bob's radio—eventually a part of the home equipment will be a Tungar, the battery charger which works from the house current.

When you get a Tungar for radio remember your auto battery too. It provides the added energy that every storage battery needs to make it give abundant service.

Sold by Electrical, Auto-accessory and Radio dealers.



Tungar is one of the many scientific achievements contributed by the G-E Research Laboratories toward the wonderful development of electricity in America.

Tungar Battery Charger operates on Alternating Current. Prices, size of the Recharge (for cycle Outlets)—ampere complete, \$8.00; 1 ampere complete, \$6.00. Special attachment for charging 2 or 24 cell "B" Storage Battery \$7.00. Special attachment for charging 2 or 4 volt "A" Storage Battery \$1.25. Both attachments for either Tungar.



Tungar

BATTERY CHARGER

Tungar—a registered trade mark—is found only on the genuine. Look for it on the name plate.

Merchandise Department
General Electric Company
Bridgeport, Connecticut

Baby's Crib and Play Pen Built from Home Workshop Blueprint

ARE you making full use of the Home Workshop Blueprints? Many readers are and they are unanimous in their enthusiasm for the blueprint service.

To the Home Workshop a good blueprint is like a master's touch. It gives you all the information he needs to carry a project to a successful conclusion—cutting list, assembly drawing, full-size details of im-



This crib was constructed by Charles C. Greenman with the aid of Home Workshop Blueprint No. 26

portant parts, the types of joints, and the method of applying hardware and fittings.

The baby's crib and play pen illustrated was made from Blueprint No. 26 by Charles C. Greenman, of Bedford, Halifax Co., Nova Scotia, Canada. He says:

"I hope you will continue issuing these prints as they certainly are great. I have had several and expect to start the kitchen cabinet table in a few days' time."

Complete List of Blueprints

ANY one of the blueprints listed below can be obtained from POPULAR SCIENCE MONTHLY for 25 cents. The Editor will be glad to provide, upon request, information relative to tools, material, or equipment.

Blueprint Service Dept.

Popular Science Monthly

225 West 39th St., New York

GENTLEMEN

Send me the blueprint, or blueprints, I have checked below, for which I inclose cents in stamps or coin.

No.	Title	Price
1	Sewing Table	25c
2	Smoking Cabinet	25c
3	Book Trough End Table	25c
4	Kitchen Cabinet	25c
5	V. T. Radio Receiving Set	25c
6	Shaving Cabinet	25c
7	Arbor with Gate and Seats	25c
8	Porch Swing	25c
9	Bench and Tilt-Top Table	25c
10	Electric Washing Machine	25c
11	Tea Wagon	25c
12	Toy Train, Horse, and House	25c
13	Home Workshop Bench	25c
14	Island Radio Cabinet	25c
15	Cedar and Mahogany Chest	25c
16	Telephone Table and Stand	25c
17	Grandfather's Clock	25c
18	Flat Top Desk	25c
19	Colonial Writing Desk	25c
20	Girl's Cabinet and Desk	25c
21	Pergola Garage	25c
22	Outlet Table	25c
23	Sailing Outfit for Canoe	25c
24	Baby's Crib and Play Pen	25c
25	Kitchen Cabinet Work Table	25c
26	Pullman Play Table	25c
27	Toy Tea Cart, Garage, etc	25c
28	Tool Cabinet, Bench Hook, etc	25c
29	Practical Sewing Cabinets	25c
30	Chinese Game Table	25c

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City and State

GENERAL ELECTRIC

21 Jewel Burlington

Used on nearly every watch in the U. S. Navy. Baby and Poppet's Jew. 10 year gold watch case. Only 11.00. Balance to suit. Payment. Send for free book TODAY!

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Motorcycle Bargains

SAVE 25% to 65%

on Slightly Used and Rebuilt Motorcycles, Air Indian, Excelsior, Harley Davidson, Cleveland, Side Cars, Johnson Motor, Wards, Evans, Power Cycles, Bircyl. Send for Free Bargain Bulletin and Money Saving Message, listing hundreds of bargains in used, rebuilt and new machines, supplies, accessories.

AMERICAN MOTOR CYCLE CO.
Dept. 328 2047 W. Chicago Ave. CHICAGO

Sells for \$1.25. Agent's Sample 65c!

New Self-Filling Bombon Fountain Pen with Style Point



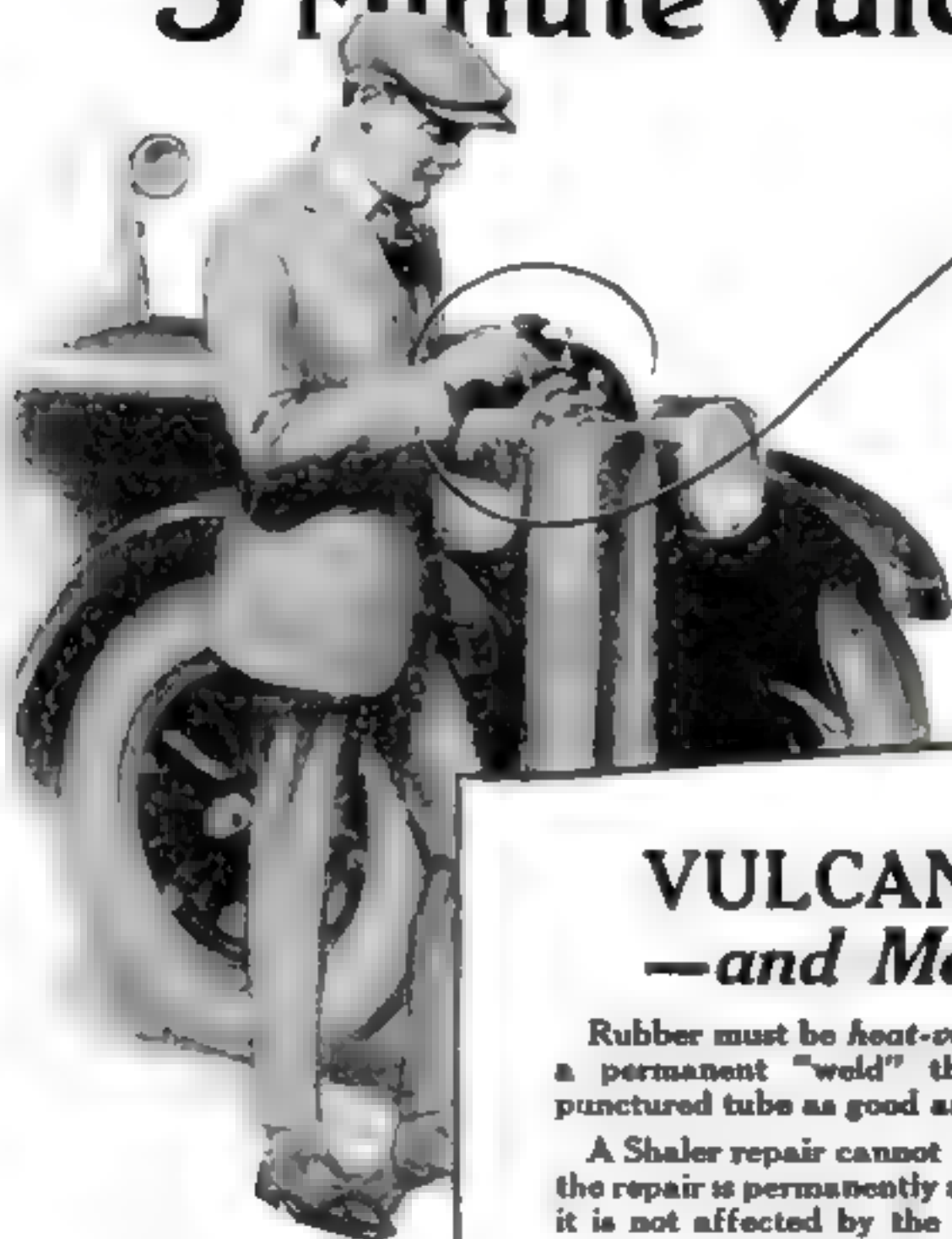
ITS THE POINT

HAS EIGHT GROOVES FOR INK TO FLOW

Imported from Japan. "It makes Carbon Copies." Guaranteed for 1 year. Hustlers Making \$20 Daily! Money refunded if you don't think it's the best pen you ever wrote with. Up to 150 per cent Profit. Send for quantity price list and distributing plan. F. SPORS & CO., 101 S. 4th St., Levee-Center, Minneapolis

SHALER

5 Minute Vulcanizer



VULCANIZE *First* —and *Make it Last*

Rubber must be *heat-vulcanized* in order to obtain a permanent "weld" that lasts, and makes the punctured tube as good as new.

A Shaler repair cannot loosen or come off, because the repair is permanently *vulcanized* to the tube so that it is not affected by the heat and friction of driving.

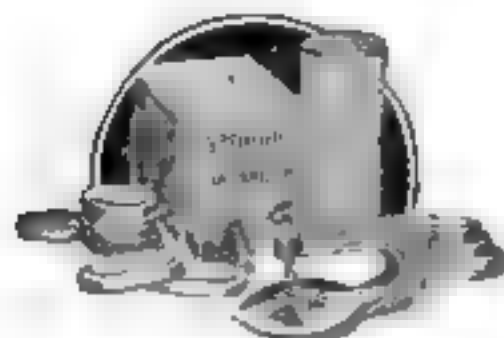
It's easier than "sticking on" patches—quicker than changing tubes. It makes a strong, durable repair that flexes perfectly with the tube—and will not come off.

Over two million motorists use the Shaler and recommend it to their friends as a guarantee against puncture troubles. It saves time, prevents delays, gives longer mileage and pays for itself many times over.

All Auto Supply Dealers Sell It

Your Auto Supply Dealer has the Shaler 5-Minute Vulcanizer in stock, probably in his window. Stop in and get one for your car today.

C. A. SHALER CO., 2100 Fourth Street, Waupun, Wis.



Complete Outfit Only \$1.50
including nickel-plated Vulcanizer
12 Patch-&-Heat Units (6 round for
punctures and 6 oblong for cuts.)
Extra Patch-&-Heat Units cost only
75 cents a dozen. Slightly higher in
Canada and far west.



"Red Devil" Tools

Make Your Everyday Repair Jobs Easy

"Red Devil" Chain Drill No. 2018 drills through metal as easily as an auger bit through wood. You take the tool to the work, instead of the work to the shop. It's automatic.

Price each \$4.50.



"Red Devil" Glass Cutter No. 024 the most popular glasser's tool in the world. The hand honed cutting wheel cuts the glass clean, clear and sharp. It's economical to do the little jobs yourself with it.

Price each, 20c



"Red Devil" Slip Joint Plier No. 030—an all-around practical tool with wire cutter, burner grip, and flat nose plier. Slip joint gives wide range to gripping jaw. About as useful a tool as any mechanic can own.

Price each, \$1.50



"Red Devil" Hack Saw Frame No. 1048. Adjustable for 8 to 12 inch blades. Depth of cut 3 1/4 inches. The steel frame is strongly constructed.

Price each, \$1.00.

THEY reduce difficult problems in the home, the office, the workshop—around the car, to surprisingly easy tasks. There is the right tool for the right job. There's no end to the number of useful things you can make and mend with them. They help you keep things in order—help you save. Forged of steel for strength.

The following are a few "Red Devil" Tools and their suggested uses:

Chain Drills:

for drilling iron, the engine cylinder, truck frame, angle irons, pipe, wagon tires, for brick, concrete, etc.

Glass Cutters:

for repairing windowpanes, glass sashes, greenhouses, for making passportouts, table tops, glass trays, aquariums, etc.

Pliers:

for repairing radio sets, gas engines, motorcycles, automobiles, trucks, tractors, vacuum cleaners, sewing machines, guns, typewriters, toys, for amateur plumbing jobs, etc.

Hack Saw Frames and Blades:

for cutting sheet metal, pipe, tubing, cables, structural steel, etc.

"Red Devil" Tools also comprise a complete line of Auger Bits, Screw Drivers, Snips, Wrenches, Cold Chisels, Bolt Cutters, etc. Be sure to look for the "Red Devil" trade mark on each and every tool. Your dealer has them in stock—if not, he can get them for you.

Send for the "Red Devil" Mechanic's tool booklet—a handy reference guide for users of good tools.

Smith & Hemenway Company, Inc.

Manufacturers of "Red Devil" Tools

264 Broadway

New York





Announcing—

A New Radio Frequency Transformer

—in a combination unit, consisting of transformer, tube socket and rheostat.

Especially designed for use in tuned radio frequency circuits—the most practical method of amplifying high (radio) frequency impulses.

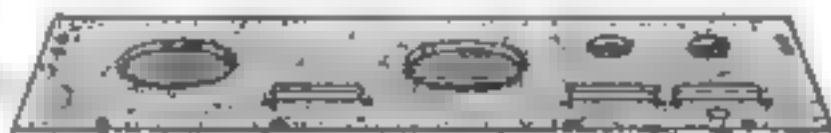
The trend toward radio frequency amplification is to be expected. Its advantages are many—long distance reception; the excellent results obtained with indoor aeriels, and an entire absence of interference with neighboring receivers.

When incorporated in a tuned radio frequency circuit, this transformer amplifies efficiently at all wave lengths employed in present-day broadcasting.

All Eisemann units are matched one to the other, not only in their electrical co-relation but also in appearance, and, when assembled, present a harmonious whole.

Complete instructions for wiring are given, and the individual not deeply versed in Radio can build a receiver with assurance of results.

Catalog sent on request



EISEMANN MAGNETO CORPORATION

WILLIAM N. SHAW, President

40 Thirty-Third Street

Brooklyn, N. Y.

Chinese Game Table

(Continued from page 85)

1 7/16 by 2 1/4 in. The eight end bins are pieces 1 1/4 by 1 11/16 by 5 in., hollowed in the upper surface. The eight center bins are 1 1/4 by 1 11/16 by 10 3/16 in. The 12 bin divisions are 3/4 by 1 3/4 by 1 9/16 in. The four filling pieces that form the inside partition between the bins and the playing surface of the table are 5/16 by 1 3/16 in. by 2 ft. 11 1/4 in. They are notched at each corner (Fig. 8, page 83) so as to allow four small lids to be used for the four square corner compartments. These compartments, the construction of which is clearly shown in Fig. 8, are for holding the dice and other small objects.

The main table top or center board is glued up from pine or poplar 3/4 in. by 2 ft. 7 in. by 2 ft. 7 in. It is covered with cork, cork linoleum, or rubber 1/4 in. thick, and with a piece of felt table cover 2 ft. 9 in. by 2 ft. 9 in. The cloth is turned over and tacked to the board base edges.

The whole top is simply dropped into place and fastened with screws from underneath the table frame. The ashtrays in this case are turned from 1 1/4 by 2 1/4 by 2 1/4 in. wood with glass inserts. Beside the hinges, four brass elbow brake braces or stays 10 in. long, and four silent castor domes 1 in. in diameter are needed.

Obtaining an Oriental Finish

One of the most effective finishes for the table is an Oriental black. This is obtained by giving one priming and one finishing coat of flat red paint, preferably vermilion coach color, but, in any event, a very brilliant red of fine quality. The second coat is smoothed with 00 sandpaper and then covered with one or two coats of rich black furniture enamel. The final coat is rubbed vigorously with FF powdered pumice-stone and rubbing oil, raw linseed oil, or sewing-machine oil. The enamel is rubbed hard so that the vermilion shines through in places and gives a warm underglow. The general tone is then one of an antique Oriental piece, black lacquered over red.

This type of table is also frequently finished in ivory black and occasionally in walnut or mahogany.

The shop drawings of this table, with full-size details of the essential construction and a completely itemized bill of materials or cutting list, are contained in Blueprint No. 82 of the Home Workshop series. This can be obtained for a nominal charge of 25 cents from the Blueprint Service Department, POPULAR SCIENCE MONTHLY, 225 West 39th St., New York.

For the Woodworker

TWO practical designs for dining alcoves will appear in the April Home Workshop.

Among other articles scheduled for early publication is one by Edwin M. Love on time-saving tricks of the carpenter's trade for home workers, another by S. W. Blanchard, "Habitant's Chair, Built by Home Craftsmen," and a third on building a corner china closet.

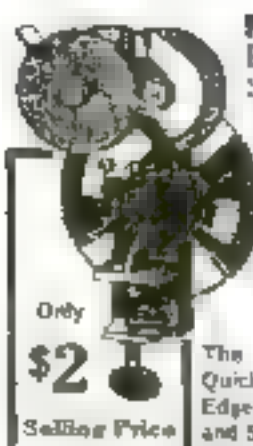
We Want Agents at \$50 to \$90 a Week

New Invention—Just out. Needed in every home every day. Patented. Nothing else like it. Low priced—Sells on sight. Sharpens any kitchen knife, paring knife, carving knife, bread knife, or shears and scissors in **ten seconds**. Mechanical masterpiece. A child can use it. Just put knife in slot, turn crank—sharpens both sides at once automatically. **We want representatives at once—men and women hustlers.** Get this position where profits start first day.

No Experience Necessary—200% Profit

Make so much money next week as these men are making now. J. C. Lewis, of Kansas, says: "I have sold one hundred sharpeners in four days." Herbert Kerr, of Md., writes: "The women can hardly wait till they get them." Herbert Cain, of Ky., sold nine after supper. At the end of the first day J. W. Gordon, of Pa., writes: "I sold two dozen and I could do every one I saw." Wm. C. Hall, of N. J., says: "I think it is great. I sold one in about one-half hour. The machine is a mighty fine proposition. I am a merchant and I know what I am talking about." You can make this money. **WRITE TODAY. TERRY TERRY CO., 601 Broadway, New York.**

QUICKEDGE SHARPENER CO. 601 Broadway, New York.



Only

\$2

Selling Price

The Quick-Edge Knife and Shear Sharpener



The blustery, rainy days filled with joyous entertainment

TO experience the thrill of supreme radio enjoyment, add to your equipment a Magnavox Combination Set as here illustrated.

This instrument combines a Magnavox Electro-Dynamic Reproducer and Power Amplifier in one marvelous unit—with it you can reproduce those distant stations you have always wanted to hear.

The first trial will convince you that Magnavox Combination Sets are a notable contribution to the radio art.

For permanent radio satisfaction choose Magnavox.

Magnavox Reproducers: All the dry battery sets, R1 and R2 Electro-Dynamic . . . \$35 to \$60

Magnavox Combination Sets: Electro-dynamic Reproducer with one or two stages of amplification . . . \$59 to \$85

Magnavox Power Amplifiers: may be had in one, two or three stage (audio-frequency) . . . \$27.50 to \$75

Magnavox Products are for sale at good dealers everywhere. Write for catalogue.

THE MAGNAVOX CO.

Oakland, Calif.

New York Office: 310 SEVENTH AVE.
Perkins Bldg. (Lower Third Floor) Montreal
Winnipeg, Canadian Distributors

*For Every Receiving Set
there is a MAGNAVOX*

Exit Variocoupler Enter Erla Selectoformer



Superior worth of Erla audio transformer shown in their exclusive ability to amplify three stages without distortion, improve any set. 25c



Erla condensers alone carry a certificate of accuracy on their labels. Look for the words "Tested Capacity" when buying. 35c to 75c ea.



Patented telescoping rim of Erla headset fits any 4 1/2" in panel, neatly screening openings required for tube ventilation. Nickel or enamel, 20c



Reliable and clear reception is assured through the Erla fixed crystal rectifier requiring no adjustment and lasting indefinitely. List \$1

Combines Improved Properties of Coupler and Wavetrap

Again Erla contributes notably to radio advancement. Erla Selectoformer, replacing alike variocoupler and wavetrap, greatly increases volume and selectivity in radio receivers, at the same time reducing cost.

Selectoformer, as the name implies, operates simultaneously as a selector and radio frequency transformer, picking off of the antenna the one wavelength desired and amplifying it to normal strength.

Thus is avoided the interference common to receivers that depend for selectivity upon tuning the coarse antenna system. Also, because of the amplification brought to bear, there is eliminated the loss of energy encountered in wavetraps of conventional type.

With Selectoformer, distant signals come in loud and clear, even with powerful local broadcasting in progress. Tone quality, likewise, is greatly improved, through reduction of static and other disturbances.

Control of the Selectoformer is effected through the 23-plate condenser already built into most receiving units. Installation is a matter of moments only.

For complete details regarding this and other Erla improvements, including latest reflex circuits, ask your dealer for Erla Bulletin No. 20, distributed gratis; or write, giving your dealer's name.

Electrical Research Laboratories
Dept. F 2515 Michigan Ave., Chicago

ERLA

Trap-Shooting with Homemade Catapult and Tin "Birds"

By John Edwin Hogg

NEXT to game hunting, shotgun shooting at clay birds, or other forms of flying targets, offers the most alluring sport with the gun. Clay target shooting, however, is denied to many because of the expense and effort to reduce the cost of the sport. Recently developed tin targets, however, hurls

to build the catapult.

It consists of a wooden frame stoutly reinforced with metal cleats, and a wooden hurling arm, to which motive power is supplied by stretching two discarded motor tubes. Light and compact, the catapult may be hauled



Shooting at the tinware birds above ready to spring the catapult below

to and from the shooting grounds on the runningboard of a small roadster.

On the shooting grounds it is necessary to have on hand only a supply of old tin cans. The hurling arm, which is pressed downward to bring the inner tubes under tension, is latched and the cans are placed on the arm. A cord fastened to the latch frees the hurling arm at the will of the shooter. The arm flies up, strikes the top of the frame, and the tinware keeps on going—usually about 100 ft. in the air.

The shooting grounds chosen for experimentation with the catapult is near the city dumping ground at Alhambra, Calif., where there is an unlimited supply of tinware to be shot at. Once built, and transported to the scene of activities, the operation of the catapult costs nothing. It will throw tin cans all day to provide a most excellent and inexpensive form of shotgun target shooting.

Keeping an Auto Tuned Up

EVERY motorist will find many labor- and money-saving suggestions in a new series of articles by Ray F. Kuns, the first of which is scheduled for early publication in the Home Workshop Department. His first article tells how to eliminate spark-plug trouble and he cites as an example a motorist who makes a set of plugs last at least 28,000 miles.

Deafness



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7015 days or 7020 days or 7025 days or 7030 days or 7035 days or 7040 days or 7045 days or 7050 days or 7055 days or 7060 days or 7065 days or 7070 days or 70

A Radio Statement to the Public

The Meaning of Coordinated Scientific Research

KEEPING its pledge to the public, the Radio Corporation of America has concentrated its vast research and engineering forces upon the solution of certain fundamental problems facing the art—problems which have become more apparent as broadcasting stations and radio receivers multiply.

The phenomenal expansion of the radio industry, and the universal and ever-increasing appeal of radio represent an outstanding development of the present century—for this industry has grown from infancy to maturity in a space of but two years.

• • •

Briefly stated, there is today a necessity for

—*A radio receiver providing super-selectivity*—the ability to select the station you want—whether or not local stations operate. A selectivity which goes to the theoretical limits of the science.

—*Super-sensitiveness*—meaning volume from distant stations—along with selectivity

—*Improved acoustics*—more faithful reproduction of broadcasted voice and music than has ever been possible before.

—*"Non-radiating" receivers*—a new development, a type of receiver which, no matter how handled, will not interfere with your neighbor's enjoyment.

—*More simplified operation*—a super-receiver requiring no technical skill, thus making the greatest achievements of entertainment immediately available to all members of the family.

—*A receiver for the apartment house and populated districts, requiring neither aerial nor ground connection.*

—*Another type of improved receiver for the suburban districts, equally capable to that above, for use where the erection of an aerial presents no problem*

• • •

Painstaking search in quest of these ideals has led to new discoveries, setting new standards of excellence and performance—discoveries which have established:

First—that improved acoustics are possible—a matter of scientific research and not of haphazard design—for truly melodious reception.

Second—that dry battery operated sets can be so designed as to give both *volume* and *distance*.

Third—that the regenerative receiver is susceptible to marked improvement providing selectivity, sensitiveness and simplicity of operation hitherto deemed impossible of accomplishment.

Fourth—that the Super-Heterodyne—the hitherto complicated device requiring engineering skill to operate—could be vastly improved—improved in sensitiveness and selectivity—and simplified so that the very novice and the layman could enter new regions of entertainment and delight.

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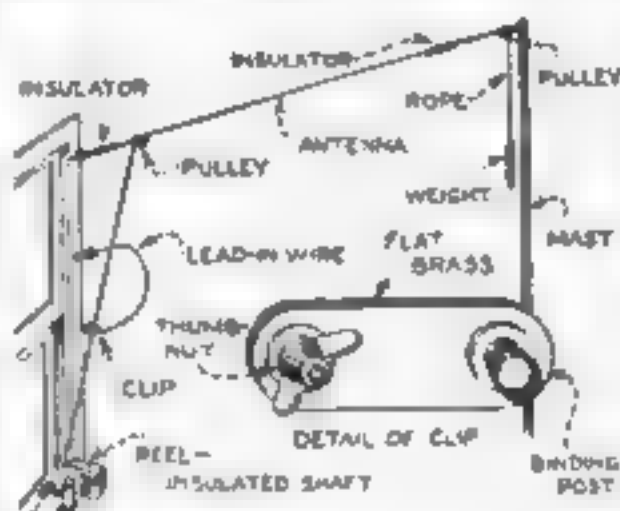
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| Electric Light & Power | High School Graduate |
| General Education | Fire Insurance Expert |
| Vocational Guidance | Wireless Radio |
| Business Law | Undecided |

Serial with Length Adjustment Improves Radio Reception

By L. B. Robbins

FOR maximum efficiency in radio reception, the antenna must be the right length. Some radio fans have several aerials of different lengths, but this is not necessary if the antenna is adjustable.

Erect the masts at the greatest possible distance apart, say 200 ft. The farther mast from the set should have a fixed pulley at its peak, the nearer mast a movable pulley fastened by means of a short rope. Provide a 225-ft. antenna



By reeling in or letting out the aerial the utmost efficiency is insured

and fasten the farther end to an insulator, which is fastened, in turn, to a rope that runs down through the fixed pulley and ends in a weight.

The near end of the antenna is then run down through the suspended pulley and fastened to a reel with an insulated shaft and drum. When the reel is wound up, the antenna is pulled toward the nearer mast and thus shortened. When the reel is unwound, the weight carries the antenna up again and stretches its length between the masts.

The vertical part of the wire acts as part of the lead in. A clip can be clamped on this lead-in wire at the most convenient point. Any kind of clip can be used, but one that will be positive and will stand the wear and tear is illustrated

Extending Usefulness of Pliers

With ordinary pliers for handling a number of small things, they usually may be made to open automatically by winding a rubber band around the handles, close up to the joint. This will not prevent their closing.

To use a pair of pliers as a small vise, hold the jaws together with a small C clamp, such as may be obtained at hardware stores for about 10 cents.—E. A. M.

A good soldering flux can be made by dissolving powdered rosin in alcohol and adding a little glycerin to prevent drying or caking. This may be used with thin wire-solder and a well-tinned soldering copper to produce perfect electrical connections.



Spin All Nuts On—

It's so easy now—assemble any radio hook up in half the time—make connections leakproof as soldering with

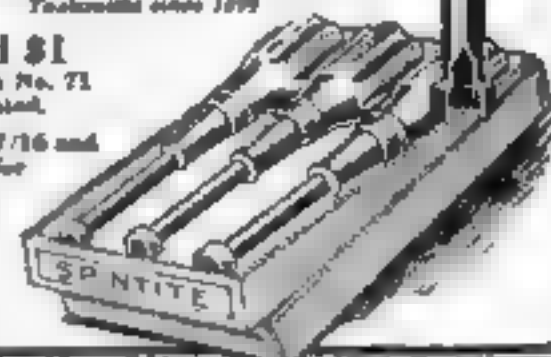
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Free Clothes and Cash Profits Besides. You can easily earn \$20 in cash, extra, every week during your spare time, taking orders for our made-to-measure clothes. We don't ask you to use your cash profits for your own clothes. That's not our way of doing business. Ours is a new and better plan.

Simple plan, real cash profits—FREE. No cash profit, trade wholesale prices—everything FREE. Just drop us a line today and we will send complete order FREE.

SPENCER MEAD CO., Dept. 6517 Chicago

*3 Cash Days Typewriter

Balance Only \$5 Monthly. Save 15 to 40% on all standard makes—Underwood, Royal, Remington, etc. Every machine thoroughly tested and GUARANTEED 12 months or our expense before you buy. WRITE us now for Free Descriptive Circular and Special Low Prices.

Wynn Typewriter Exchange 22 Columbia Street, Kansas City, Mo.



**This Radio
Catalogue
FREE**

Save $\frac{1}{3}$ on Guaranteed Radio Equipment

Write us a post card

Address Dept. 5-R

and we will send you free this 52 page catalogue of radio sets and parts. It also contains explanation of radio terms, map and list of broadcasting stations and much radio information, including an explanation of successful hook-ups and circuits.

You will be amazed at the low prices Ward's quote. A complete tube set having a range of 500 miles and more, including tube, head set, batteries, and antenna equipment, as low as \$23.50.

This catalogue contains everything for the expert and amateur. Complete sets and every improved part for building sets, all the most up-to-date devices—at the lowest possible prices.

Headquarters for Radio

Montgomery Ward & Co. is headquarters for Radio, selling everything direct by mail without the usual "Radio-profits." Why pay higher prices? Ward quality is the best and the prices will often save you one-third. Everything sold under our Fifty Year Old Guarantee—Your Money Back if You Are Not Satisfied. Write today for your copy of this complete 52-page Radio Book.

Write to our house nearest you. Address Dept. 5-R

Chicago Kansas City St. Paul Portland, Ore.
Ft. Worth Oakland, Cal.

Montgomery Ward & Co.

Established 1872

The Oldest Mail Order House is Today the Most Progressive

"What a whale of a difference
just a few cents make!"

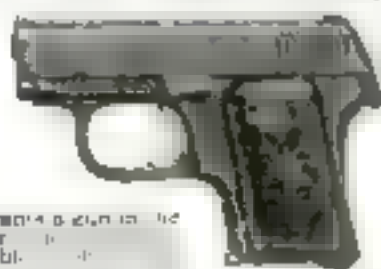
—all the difference

between just an ordinary cigarette
and—FATIMA, the most skillful
blend in cigarette history.

Home Protection

with an
ASTRA
Automatic

will cost little



Nearly every man wants a gun in his house—he feels better in his family. We are able to guarantee Astra guns as standard units because we bought before recent tariff duties became effective. Really fine guns, beautifully finished, latest design. True standard composition. Order direct from U. S. Importers.

\$7.75 35 calibre—7 shot—C. O. Q. Automatic.
8 00 35 calibre—7 shot—Astra Automatic.
9 98 35 calibre Astra with triple safety.
10 98 32 calibre—10 shot Astra, extra magazine.
14 98 32-30 and 34 cal. swing-out cyl. revolvers.

We guarantee every gun against defective workmanship, brand new of Drop Forged Steel Throughout. Before buying any weapon INSIST on this guarantee. **SEND NO MONEY** unless you wish. State model desired—pay postman on delivery plus postage. Satisfaction guaranteed or money refunded. Write for new Brema catalogue.

CALIFORNIA TRADING CO.

Dept. 11, Terminal Bldg., Los Angeles, Cal.

I Teach By Mail

Have to Brema a Good Petunia **FREE!**

427 7th Ave. New York, N. Y.

Sturdy Flower Box and Stand

Hold Indoor Garden

By Kenneth R. LaVoy

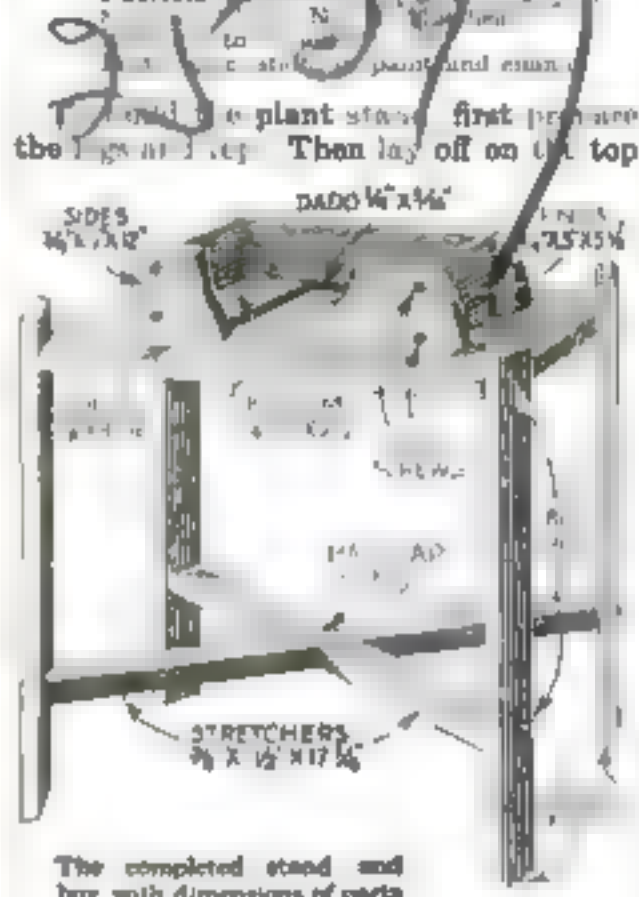
THE plant stand and flower box illustrated can be used for ferns, potted plants, or water-growing bulbs that will keep a bit of summer in the house all year round.

The materials needed for the stand are:

1 top, $\frac{1}{4}$ by 6 by 18 in.
4 legs, $\frac{3}{4}$ by 2 $\frac{1}{2}$ by 22 in.
2 stretchers, $\frac{3}{4}$ by 1 $\frac{1}{4}$ by 17 $\frac{1}{4}$ in.
Eightpenny finishing nails

For the flower box:

2 sides, $\frac{1}{4}$ by 3 by 18 in.
2 ends, $\frac{1}{4}$ by 3 by 18 in.
1 bottom, $\frac{1}{4}$ by 3 by 18 in.



light penciled lines to represent the diagonal stretchers. Get the stretchers ready, allowing 1 in. extra length for fitting the ends. Place one stretcher on the top along the lines already laid out and mark the cross-lap joint from the lines indicating the other stretcher. Next, cut the ends to correspond in length with the top. Do the same with the other stretcher and cut the half-lap in both. If done carefully, the pieces will fit together.

In assembling, fasten the legs first to the top and then to the stretchers. The half-lap joint may be fastened with glue or with a $\frac{3}{4}$ -in. bright head screw from the under side. Use eightpenny finishing nails for assembling and set the heads so that the holes can be plugged with putty.

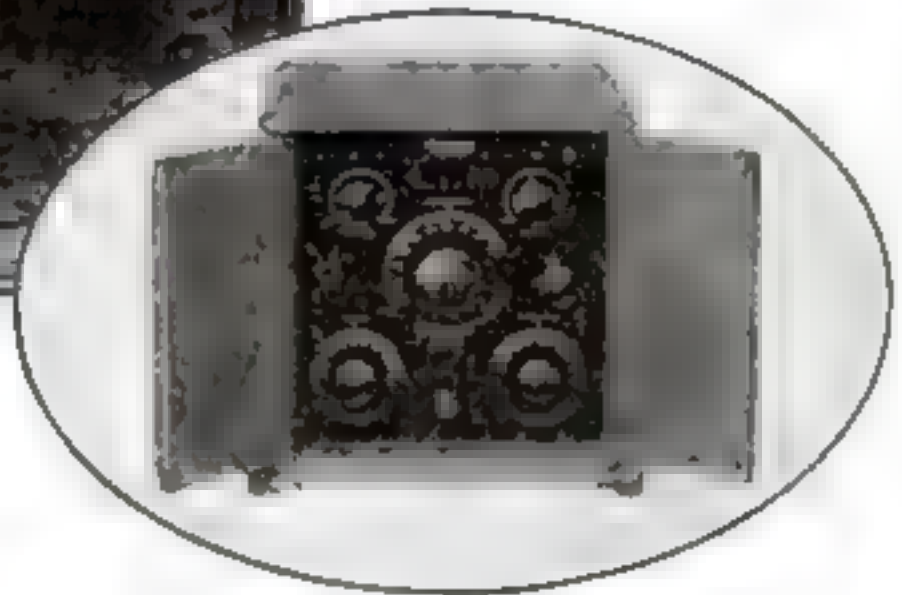
The dado on the sides and ends of the flower box is made with a combination plane or with a chisel. It should be at least $\frac{5}{16}$ in. deep to allow for the expansion of the bottom. First place one end and side together, put the bottom in position, and fasten the second side, leaving the other end until the last.

If the work is to be stained, hard wood should be used, but any soft wood will do for paint and enamel. A pleasing finish is to enamel both stand and box and then apply a simple stencil design to the sides of the box and on each leg of the stand.

A bread tin makes a cheap and watertight lining, and can easily be moved, when necessary, to replace the flowers.



Paragon
Model III \$175.00



The Last Word In a Paragon Receiver for the Home

At last—a radio set that not only harmonizes with your furniture but adds to the attractiveness of any room in which it is placed. And not an ordinary radio set but a PARAGON.

Paragon Receivers are famous for the long distance records they hold which include the reception of the first trans-continental amateur message and the first trans-Atlantic message. It is a Paragon that keeps the world in touch with the MacMillan Expedition frozen in north of Greenland.

Paragon Receivers, because of their superior selectivity and sensitivity, are equally famous for the ease with which they can be operated and the clear results obtainable.

Now comes the latest Paragon, the Model III, pictured above, with all the advantages of the other models but housed in a mahogany or burled walnut cabinet which is a work of art.

In appearance, the Paragon Model III Receiver now matches up in every way to the perfection of the instrument itself.

Illustrated Bulletins of Paragon Radio Products are yours for the asking.

Dealers: We believe in the proper distribution of Paragon Radio Products. Our Exclusive Distributors are particularly interested in territorially protected dealers, who will concentrate, solicit and serve the consumer in the sale of Paragon Radio Receivers. If interested, write us for details.

ADAMS-MORGAN CO., - 18 Alvin Avenue - Upper Montclair, N. J.

PARAGON

Reg. U. S. Pat. Off.

RADIO PRODUCTS

Coto

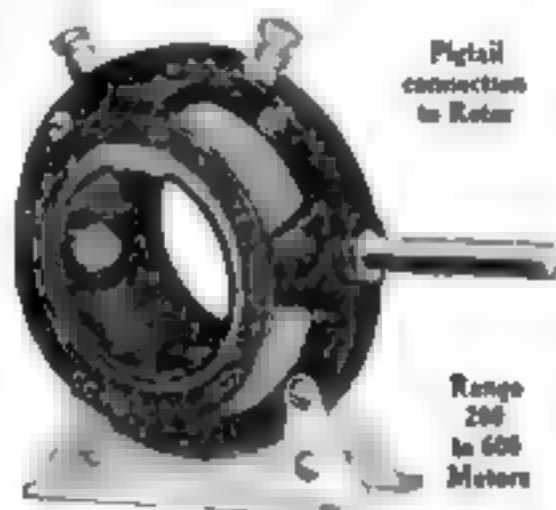
"Built First to Last"

Beginners, Experienced Amateurs and Experimenters Turn to Coto for Radio Parts

You can build from the very simplest radio set up to one with the latest refinements with Coto parts. And what is more fascinating than to try out the various circuits as they are published? And with Coto parts you know you will be getting the very best from these circuits. Learn the A. B. C. of radio—"Always Buy Coto."

Use All the Energy in Your Antenna

Don't waste it in the insulation losses of an inferior condenser. It's like pouring water in a sieve. The low losses of a Coto Condenser insure maximum signal strength. Use one and be convinced.



Pigtail
connection
to Rotor

Range
200
to 600
Meters



Coto Variable Air Condenser WITH VERNIER

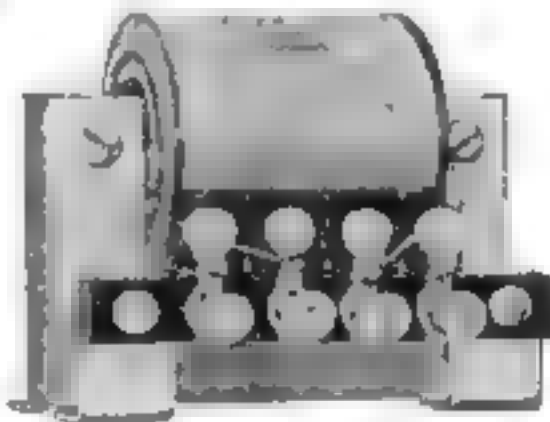
There is just one bearing in this condenser and that is protected with hard rubber, the best known radio insulator. Plates are of SILVER PLATED copper, soldered rigidly in place for lasting efficiency. Complete with vernier adjustment and handsome dial. Type 3505, 0005 Mfd. \$5. Type 3510, .001 Mfd. \$6.

GUARANTEE!

Every piece of Coto Radio apparatus is Laboratory Tested before shipment. So we authorize dealers and jobbers to guarantee you absolute satisfaction.

"Superior to Any Other Regardless of Price"

Mr. W. R. Reschke of Staten Island, New York, writes us,—"I am forced to write you this letter. I have been using your Coto Transformers in quite a number of sets and find them superior to any other transformer regardless of price. The results I get I cannot equal with other audio transformers, clear and plenty of amplification. Am using WD11, WD17 and U V 201 A tubes."



Type 4500

The 3 to 1 Ratio Audio Frequency Transformer Is Best for All Stages

Again the simple, economical, easy way proves best in radio. For an amplification unit that will be a real sweet singer without shielding, jockeying or fuss, Coto Specials in all stages is your sure and money saving bet. Great for reflex circuits too. Low price (\$2.50) is their least recommendation. Jobbers are ordering in thousand lots.

"So Much Better than Your Advertising Claimed"

These are the words of a pleased user of Coto Compact Moulded Variometer. He was surprised because of its wonderfully compact size ($3\frac{1}{2} \times 1\frac{1}{2} \times 3\frac{1}{2}$ in.) to find it splendidly efficient over the broadcasting wave lengths 200 to 600 meters. Price \$5. The Coto Moulded Variocoupler to match is just as fine, \$5.50.

The Tube with Double Grip and Hard Rubber Insulation



Cotogrip contact, and the best radio insulation prevents leakage. 85c

COTO-COIL CO.

87 Willard Ave., Providence, R. I.

BRANCH OFFICES:

Los Angeles, 329 Union Square Bldg.
Minneapolis, Gen. F. Darling, 76 Plymouth Bldg.
Atlanta, C. P. Atkinson, Atlanta Trust Co. Bldg.

CANADIAN DISTRIBUTOR:

PERKINS ELECTRIC CO., LTD.
MONTREAL, QUEBEC, CANADA

The Original Honeycomb Wound Coils

Years of factory experience in quantity production account for combined extra quality and low price.



\$1662⁰⁰ Earned IN ONE SEASON

A NEW BUSINESS—BIG BUSINESS

A Business to Enthuse Over—

The "Ideal" Lawn Mower Sharpener

A wonderful invention that sharpens lawn mowers scientifically—quickly—perfectly; does the work as nothing else can.

Fred C. Milbert of Melrose Park, Ill., writes:

"The Ideal Lawnmower Grinder put me in business, starting in the basement of my home and forcing me now for the third time to move into bigger quarters. Today the dream of my life—a shop of my own—is realized. With a machine like yours and a little hustle any man can have a business of his own and be independent."

You Start Now No town is too small. Lawn mowers are dull—owner doesn't know where to get them sharpened. Mowing the lawn dreaded because of dull or improperly sharpened mower. Lawn mowing is healthful, invigorating and pleasant when Mower is "Ideally" sharpened. You do the work scientifically—you are in big demand.

W. F. Smith, 1474 Main St., Portland, Oregon
I sharpened 304 lawnmowers last season and the business was ideal which is not hard for you to do.



Lawn Mowers Sharpened to Razor Edge—

People glad—owners delight in mowing lawn with mower sharpened on an "Ideal." Mower runs light—click-click-click and the grass is cut. Build permanent business for yourself. Start now!

Write Today

Get our proposition Free. We have detailed illustrated book to send you. Write today for our proposition.

USE THIS — MAIL IT TODAY
The Fats-Root-Heath Company
202 Bell St., Dept. 30 Plymouth, O.
Please mail at once details of your complete proposition.

The Fats-Root-Heath Company
Dept. 30, 202 Bell St., Plymouth, O.

Home Workshop Chemistry

(Continued from page 126)

months. A mold was shaped in it by scratching it gently with a knife. Metal cast in this way is much easier to handle than if it is in lumps or flat pieces.

The same low melting alloy can be used to solder the connections of a radio coil, the heat being applied by a match or a small alcohol lamp or blowpipe. The solder will melt quickly and run freely under the heat of a match.

Soft pewter and other low melting metals are easily soldered with a soft solder consisting of 5 parts (by weight) of bismuth, 3 of tin, and 2 of lead. It melts at approximately 212° F. Care must be taken in soldering easily fusible metals together to be sure that the solder melts at a lower temperature than the metals to be united.

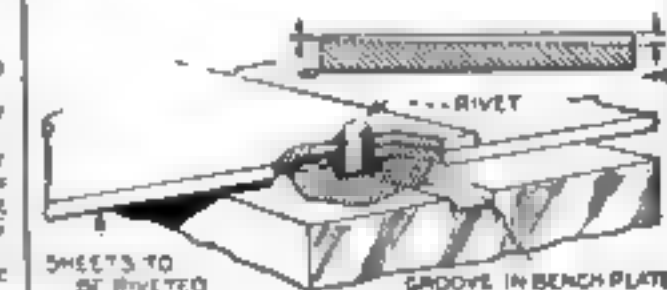
Fluxes are used with most solders in order to absorb oxygen and prevent the metals from forming oxides. Calcined borax, which is a neutral salt, has the property of dissolving the oxide formed while soldering. Another neutral soldering flux often employed with success is powdered rosin or tallow, although beeswax is better than the last-mentioned substance. If none of these substances or no commercial flux is at hand, a wax candle will often serve with fair success.

Aluminum is most difficult to solder. It takes up oxygen too readily when heated, and also gives up its heat too quickly. The presence of phosphorus in a solder prevents oxygen absorption. An aluminum solder can, therefore, be made of 2 parts of silver, 9 parts of aluminum phosphide, 39 parts of tin, and 50 parts of zinc. This solder requires no flux.

IN CONNECTION with this article on solders and fluxes, read Mr. Laraby's "Hints on Soldering," on page 134.

Groove in Bench Plate Aids in Setting Rivets Neatly

TO RIVET two plates or sheets together, when using planing made for the occasion, it is often a round off in a troublesome job. One side will have a full head, while the other side is apt to be lumpy. A bench plate with a groove planed across its rough side will solve this difficulty. The groove



The groove, that tapers in depth, makes it easy to set plain, straight rivets.

should be planed with a taper, as shown, $\frac{1}{4}$ in. deep at the shallow end and $\frac{3}{4}$ in. at the deep end.

When using the grooved plate, slide the sheets with the inserted rivet back and forth until the proper projection on both sides has been obtained and then rivet the upper side. Next, turn the joint over and the other end of the rivet will be projecting sufficiently to head up well.

Parks "Cabinet Shop Special"

\$195.00

as illustrated with motor 1/2 h. p. Cincinnati. Send for Bulletin C-3 describing this machine in detail.



The Biggest Little Woodworker Ever Built!

You'll want this sensational Parks combination woodworker right away for your shop. Includes 8 inch rip and cross-cut saw, 4-inch jointer band-saw, boxer shaper, sander and universal motor. Only \$195 complete! Lathe attachment only \$15 extra. First-class Parks angle-steel construction, all joints electric-welded. Steel table-top. The newest thing in small shop equipment. Guaranteed 10 years.

The Parks Roll Bearing Machine Company
1547 Kiewit St., Cincinnati, O.
Cincinnati Factory: 214 S. Main St., Cincinnati, O.

PARKS
WOODWORKING MACHINES

MAN IS ON THE BRINK OF A MIGHTY DISCOVERY

Sir Oliver Lodge says he hopes this discovery will not become generally known until mankind has sufficient wisdom to handle the power that it will know. But scientists have already tapped this source of power! Not yet harnessed perhaps but yet plain enough that ANY AVERAGE PERSON can to a large extent demonstrate it in daily life.

With the use of this ENERGY you can accomplish anything humanly possible. This FACT has been proven by the actual experience of thousands of people during the last twelve months in whose hands we freely placed this amazing discovery. You not only get the idea but it applies itself to your affairs within a few days.

Nothing Impossible

Literally thousands of people changed their lives almost overnight by this revelation. With this secret Col. Adams of Salt Lake City made over \$4,000 in a few days.

Unless this power will immediately and practically WORK for you, unless you can demonstrate it as clearly as a child demonstrates electricity by turning on the electric light IT IS WORTH NOTHING TO YOU. For all men are not equal. Doubt, fear, suspicion, distrust, irresolution are chains that make slaves of many.

Five Days' Free Trial

Simply send your name, postcard will do, we will mail you postpaid CLEAR POSITIVE SIMPLE instructions that you can begin applying IN A VERY FEW HOURS. You have five days to study and examine it without cost. If it proves valuable in obtaining concrete results we leave it to you to pay us within 5 days what in your judgment it is actually worth to you or what you honestly can afford to pay. If you think it is worth nothing pay nothing simply return it. This plan seems straight and unusual. But the power and secret are ALSO strange and unusual. You WRONG only yourself if you delay.

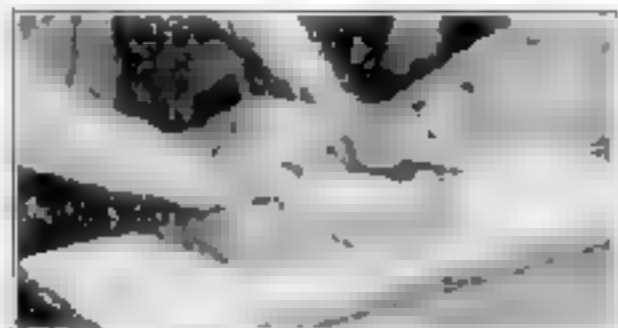
The CARNAGEY INSTITUTE

H. C. CARNAGEY, President
304 Hayes Bldg. Dept. 645 Kansas City, Mo.

Making a Wooden Holder for a Small Cabinet Scraper

FOR the finishing of small hardwood pieces, this plane-like scraper is easier to use than the ordinary flat steel cabinet scraper. It is easy to make, too. The necessary steel, wood, and screws were found in the shop. The total cost for the one illustrated was five cents, and the knob of wood and ten cent more.

Cut off a 10-in. length of 2 by 4 in. wood, and, $5\frac{1}{4}$ in. from one end, make a notch very slightly more than halfway through the block. The sides of this notch should form an angle of about 90 degrees. This angle is not important, but



The scraper in use and the few parts that are necessary for making the tool

the angle that the back surface makes with the block, is; it should be within a degree or two of 90 degrees from the perpendicular.

If an old hand scraper is available, the blade can be cut from it, 4 in. long and as wide as the rear surface of the notch, plus $\frac{1}{4}$ in. Two elongated holes are made in the steel by drilling two pairs of holes $\frac{1}{8}$ in. apart and cutting out the intermediate pieces with a chisel. The blade then can be set after the cutting edge has been worn down by sharpening. Round-head screws hold it in place.

Should this type of steel not be at hand, excellent material is obtained from an old kitchen knife blade of sufficient size or even the bit of a small plane.

The front hand grip is a wooden knob attached by a long wood screw, and the rear grip is shaped from a block of white pine 1 in. thick. It is held by long screws through the top.—DALE R. VAN HORN

Fixed Radio Condensers

EFFICIENT transmitting and receiving condensers for radio work can be made from old photographic plates.

The emulsion is first washed from the plates with hot water and the surfaces are then rubbed down with carborundum cloth, which takes off the gloss and leaves something akin to a frosted surface. The same result can be accomplished by exposing the plates to the fumes of hydrofluoric acid.

The glass is coated with ordinary aluminum paint and connections are made with small tinfoil strips sandwiched between the plates.—CARTER FISKE.



10 Shaves
FREE

See Coupon

My Life Work

The finest Shaving Cream you will ever know

By V. K. Casady, Chief Chemist

GENTLEMEN

I have devoted my life to soap chemistry. We have here developed some of the greatest soaps created. One of them—Palmolive—is the leading toilet soap of the world.

Our greatest ambition for years has been to perfect the supreme Shaving Cream. And we have done that, beyond question. Millions of men now concede it.

1,000 men consulted

Our first step was to ask 1,000 men what they most desired in a Shaving Cream. All of them agreed on four things.

But one requirement, and the greatest of all, is something no man mentioned. They were not scientists. They did not know the prime requirement in a shaving soap. That is, strong bubbles which support the hairs for cutting.

We made 130 tests

We made up 130 formulas which we discarded. Each was better than the one before. But none, in our opinion, reached the utmost in a Shaving Cream.

Then we attained, by many times over, the best Shaving Cream in existence. Someone may make a better one, but not much better. Today Palmolive Shaving Cream is monarch in its field. It is winning men by the millions, as they try it.

• • •

Don't change from the cream you like now until you see what Palmolive Shaving Cream does. But make this test. You owe it to yourself and to us. Try ten shaves, and let the results show if we have excelled the rest.

Excels in 5 ways

It multiplies itself in lather 250 times, so one-half gram suffices for a shave.

It softens the beard in one minute. No hot towels, no finger rubbing.

It maintains its creamy

fullness for ten minutes on the face.

Super-strong bubbles support the hairs for cutting.

The palm and olive oil blend acts as a lotion, leaving fine after-effects.

2704

PALMOLIVE SHAVING CREAM

Follow with Palmolive After Shaving Lotion—
An invisible way to that well-groomed look

© P. Co. 1924

10 SHAVES FREE

Simply insert your name and address
and mail to

THE PALMOLIVE COMPANY
Dept. B-423 360 N. Michigan Ave., Chicago, Ill.

Science Says Use Nu-Gas To Cook and Heat

Up-to-date homes being built without coal bins because there's a better, cleaner, easier way to cook, bake and heat, by burning free air.

"Don't buy coal at present price," says a Domestic Science Expert. Don't buy it at any price. You can get far better results by burning free air and oil in the way science has recently discovered. The government does it, the big ships do it, factories do it, and new homes are being built without coal bins or wood-sheds because their owners have adopted the new, clean, dustless, dirtless, laborless device which fits in any stove.

Oil and Free Air Make Wonder Heat

Science has shown that one part of coal oil (kerosene) the cheapest of fuels, can be mixed with twenty parts of air (by a remarkable burner) and the result is a wonderful heating and cooking gas. Cheaper than city gas. No fires to build. Heats at twist of the wrist. Heats largest rooms in a few moments on coldest morning. Heats even for baking. No dirt, smoke or soot. Saves work. Saves furniture. Saves heat. And a new way has been found to cut useless parts so that, of all burners, the NU-HEAT (the latest one) is the best and lower in price. In six led in a jiffy in your present range, heater furnace—then you are no longer a slave to coal and wood and the expense, labor and

AGENTS

Make \$50 to \$100 a week selling Nu-Heat. No experience necessary. Personal supervision. Write quick for exclusive territory and free sample heat offer.

dirty they bring. Absolutely safe. Sent on 30 days free trial. Amazing ironed guarantee. Free Book About Remarkable Way to Burn Air. Learn how to cut household bills in half. Learn to save by having all the heat you want but only when you need it. Learn cheap way to have the warmest, cleanest, coziest home in town. Just say "Send Nu-Heat Information Free." Mention if you have heater, range or furnace. No obligation to you whatever.



A twist of the wrist on arising. Intense fire almost instantly

Wade Hill Manufacturing Co.
Dept. C-41, St. Louis, Mo.

Adding Tuned Radio-Frequency to a Triple-Circuit Receiver

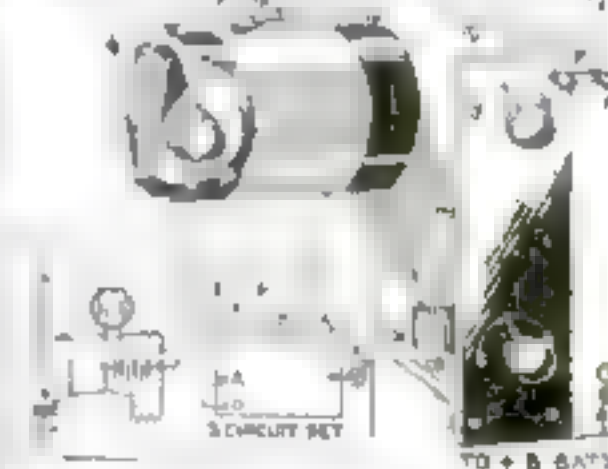
TO ADD a stage of radio-frequency to an ordinary three-circuit receiver is a simple matter if the method illustrated is followed. The unit is fastened directly to the end of the cabinet without marring it or necessitating any change in the wiring of the radio set.

Even in midsummer when the heat is bear

24944
set in
Md.
my
clearly

COIL AND SLIDER
CONDENSER

1/2 TUBE
PLATE



Circuit of one tube radio-frequency amplifier and method of mounting parts

four tubes being used. Without the radio-frequency amplification the best I could do was Atlanta, Ga.

Either make a tuning unit with 60 turns of No. 22 enamel-covered wire on a tube 3 1/2 in. in diameter and 4 in. long, as shown, or obtain an old-fashioned single-circuit tuner. Fasten a 48-plate variable condenser at one end of the tube and then follow the illustration and wiring diagram in completing the unit.

The potentiometer is 300 or 400 ohms and the rheostat should suit the type of tube used. For local reception and whenever you do not wish to use the radio-frequency unit, only the aerial and ground connections need be changed and the plus B battery line disconnected from the radio frequency tube. The unit is not adapted to a receiving set of the single-circuit type.—JOHN A. MAHON

Two Screweyes Serve in Place of a Hasp and Staple

15074
made
the padlock is to be used, it is often a problem to arrange the hasp and staple so that they cannot be removed too easily. A good method is to place two 1/2-in.

screweyes, as shown, one in the door and the other in the door casing. When the lock is in place, it is practically impossible to remove it without the key, or by cutting off one of the staples with a hacksaw. L. WHEELER.



Charge Your Radio or Auto Battery at Home Overnight for a Nickel

with the

GOLD SEAL HOMCHARGER

—the world's best as well as its most popular rectifier. Simple, dependable, practically silent and absolutely safe. Beautifully finished in mahogany and gold—an ornament for the finest living room.

WHY PAY MORE—OR GET LESS?

Why buy a 2 or 3-ampere rectifier without ammeter requiring from 40 to 50 hours to charge your battery and costing twice as much to operate when, for the same price, you can secure the genuine 5-ampere GOLD SEAL HOMCHARGER which does a better job in one-third the time and at half the cost? Fitted with high grade ammeter (eliminating guesswork) charging cable and battery clips—no extras to buy. For sale by all good dealers, \$18.50, (\$25.00 in Canada.)

INSIST ON THE GOLD SEAL

It's your guarantee against substitution and appears on name-plate and package. No other charger is just as good.



RADIO FANS, ATTENTION!

FREE Ask your dealer or send direct for free HOMCHARGER list of broadcasting stations and GOLD SEAL bulletin.

The Automatic Electrical Devices Company
131 West Third St. Cincinnati, Ohio
Largest Manufacturers of Valuable Rectifiers in the World



I pay men \$75.00 a week and up by my plan which I want to send you at once. Be your own boss, work where and when you like. You can do fine even without previous experience. Biggest values—positively sell on sight.

Profits in Advance

My plan pays biggest profits and commissions in this line, a paid in advance, we send to delivering orders and collections.

Sell Fine Tailoring

Amazing values get orders every when you show samples of our tailored to order all wool suits and overcoats—one priced 1.50. Our advertising helps you take orders quick.



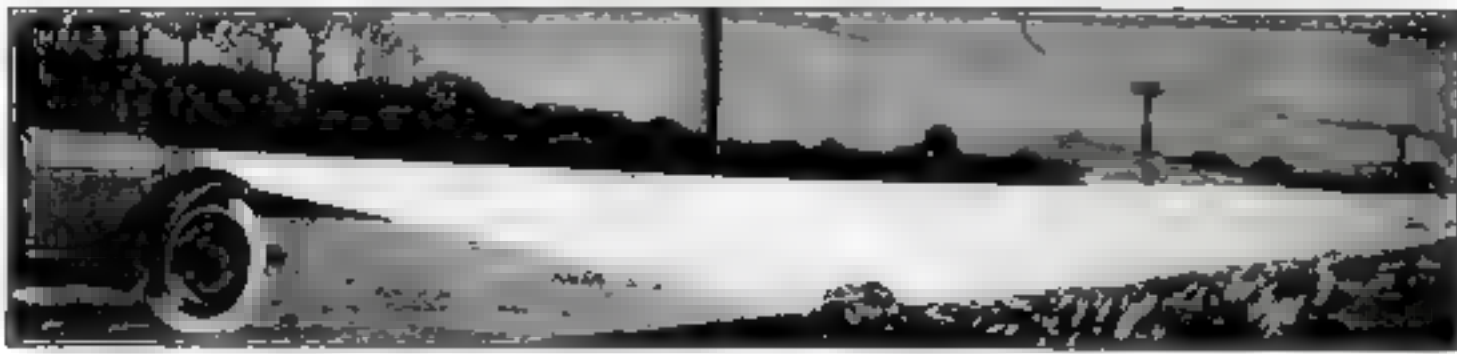
FREE

This big, fine sample outfit furnished free, contains 100 all wool big samples, all one price \$2.50, fine colored fashion stationery, supplies, tape, etc. All in classy, fine carrying case.

sales that we place you in Big Money Class.

W. E. GIBSON, Inc., Chicago, Ill.
141 West Harrison St., Dept. C-25
Please send me your plan for \$75 a week and up, also FREE outfit and sales manual.

A Perfect Glareless Headlight At Last



Distributors—Agents and Dealers—Can Make \$3,000 to \$15,000 or More a Year

The Detroit Safety Headlight Devices absolutely solve the greatest menace to auto-mobiling—the headlight glare. This is a new, simple device and fits any model of any car. Installed easily and quickly by anyone. Used with low priced plain glass lens. It

adds style and dignity to any car. It absolutely concentrates the light down on the road, not up in others' eyes. Drive with all the courtesy of the road with bright lights on. The glare is positively eliminated. Will last a lifetime. Will not rust, corrode or deteriorate. Meets every legal requirement. They are the best headlight devices made and stand any test.



PATENTED

Detroit Safety Headlight Devices Sell On Sight

They sell on sight—a demonstration sells anyone. Easily demonstrated in store, home or on car. Sold on 30 day trial—never taken out. Appeals to fairness—no one wants to drive others to death in ditch. Owners urge others to buy. See illustrations as to installation and effect.

Exclusive Territory—Newspaper Advertising—Installed Free

Exclusive territory granted to right men—we run newspaper advertising and arrange for Free installation by competent garages. Printed matter and cards also furnished.

We want men in every county who can handle men and sales and make from \$3,000 to \$15,000 or more according to territory.

FREE—One Set. Free Introductory Advertising Offer

One set of Detroit Safety Headlight Devices in a neighborhood makes everyone want them. It's the best kind of advertising for our representatives. Therefore, for a short time we will sell two sets for the price of one (\$2.00) or one set at wholesale price of \$1.00, postage paid. Buy two sets, sell one easily at \$2.00—yours will be free. This offer is open to everyone to advertise the devices. When territory Representatives are appointed offer ceases—so act now. Easily installed by anyone. Get literature—clip FREE coupon, fill in, pin \$1 or \$2 bills to coupon—act quickly NOW.

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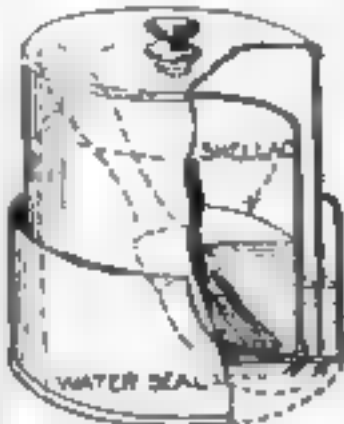
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Three Tins Form Container that Is Evaporation-Proof

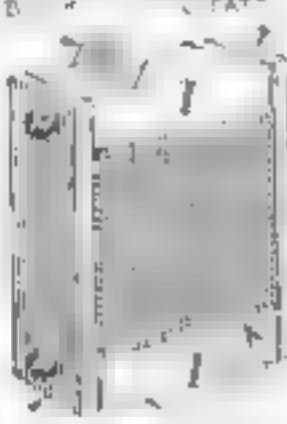
IN THE home workshop as well as in garages and shops where shellac, gasoline, thinned paints, or similar liquids are used, this evaporation-proof container is well worth making. Ordinary tin cans such as are used for paints or food products are the only material needed. The bottoms of the inside and outside cans are soft soldered or sweated together. The inner chamber is used for the liquid to be protected from evaporation, while the outer is used for oil or water used as a seal. The cover is another tin with a knob affixed to it. When it is in position, the evaporation of the shellac or other material is effectively checked.—H. S.



The lid rests in a liquid seal

Indestructible Match-Scratcher

THE surface of a common sandpaper match-scratcher quickly becomes worn and smooth and useless. A match-scratcher that will last a life time may be made quite as easily and cheaply from a block of wood covered with wire screening of 16 mesh or finer. The match-scratcher made with wire screening may be cut in a variety of interesting designs. The screening fastened on its surface by two thin cleats screwed on the sides. These scratchers are readily made in quantity for clubs, poolrooms and smoking-rooms.

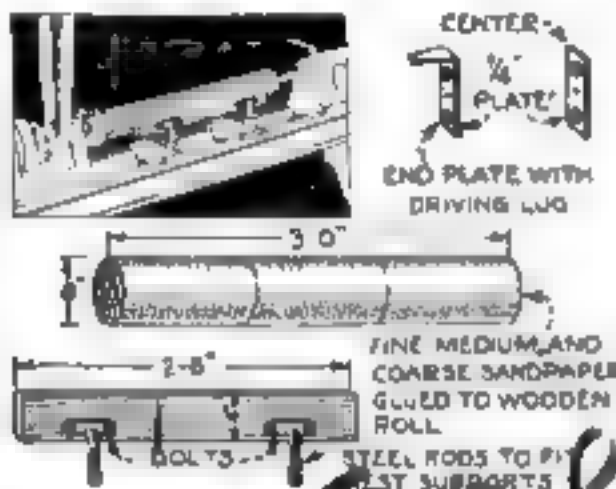


Soap Models for Castings

SMALL soft metal or Babbitt-metal castings for models can be made without an original to use from by using soap to form the pattern. The materials to use are Babbitt metal, piece of Paraffin, a bar or two of white soap, and a trowel. Using a compass, trowel, and a pencil, mark on the soap the desired shape of the part to be cast and cut it out with a narrow-bladed knife. The holes are to be left in the casting, punch them in the soap first. Fill the mold by filling any holes full of plaster of Paris mixed with water. Then surround all the model except one side with plaster. After it is thoroughly hard, dig out the soap, using bent and hooked pieces of wire for reaching into difficult recesses. Bake the mold in a hot oven for at least half an hour to remove all moisture, and pour in the molten metal.—ALDEN JOHNSON, N. Y.

Sanding Roll Is Useful Addition to Wood-Turning Lathe

THIS sanding roll has been used for a considerable time on a 6-ft. lathe for finishing woodwork, including moldings and house trim. The body of the roll, which is made of white pine or other wood, has two plates, one with a plain center and the other with a driving lug. To



A wooden roll covered with sandpaper placed in the lathe for finishing work.

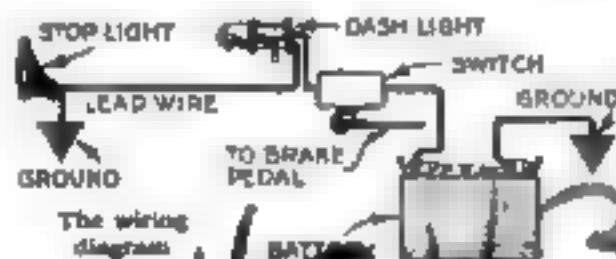
insure a true surface, the drum is turned after the plates are affixed. On the drum are glued three grades of sandpaper—coarse, medium, and fine.

In connection with the sanding roll, a long double steady rest is used. This is made by mounting a piece of oak edge-wise on two steady rest supports, as shown. The only need is the occasional renewal of the sandpaper.

Using Dash Light as Telltale for Auto-Stop Signal

WHEN the stop light on an auto fails to operate, there is generally no way that the driver can tell. If, however, this lamp and the dash light are wired in series, neither will operate if one is out of order.

An advantage of this plan is that when touring in the country, where the stop



signal is needed often, the connection can be broken by merely turning off the dash light switch. This saves the battery appreciably. The bulbs in both dash and signal lights should be the same candle-power. Since they operate in series, two bulbs designed for 8-volt circuits make a satisfactory unit for a 6-volt system.—GLEN F. STILLWELL, Collinsville, Ill.

Aluminum Runningboard Plates Cover Worn Floorboards

MANY used cars show more wear on the front floorboard than anywhere else because of the constant "digging in" of the driver's heels. Two low-priced aluminum runningboard plates will cover these worn spots and make an improvement well worth the small outlay of money and time necessary.—R. C. T.

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Keeping the Home Shipshape

How to do the odd jobs that save time,
trouble, and money.



Soldering Hints

IN KEEPING any home shipshape, soldering plays an important part. Countless odd repairs can be made with a soldering copper. Gutters and downspouts can be repaired, pans and kitchenware patched, broken metal parts fastened together, and even jewelry mended. For electrical wiring and radio work, of course, a knowledge of how to solder thoroughly and quickly is very essential.

For my own use I have two coppers, one weighing about $\frac{1}{2}$ lb. for ordinary work, and a heavier one for soldering seams and larger work. Such coppers may be bought at any hardware store, but if one can obtain a piece of copper about $1\frac{1}{2}$ in. in diameter and 8 in. long, it is very easy to make a soldering copper. Simply bore a $\frac{3}{8}$ -in. hole across the copper, about $\frac{1}{4}$ in. from the end, and bend a $\frac{3}{8}$ -in. iron

rod, about 14 in. long, through the hole to hold the copper firmly. A wooden handle should then be added and the point of the copper tapered bluntly.

The copper can be heated in a gas stove, by means of a blowtorch, or with any convenient source of heat. Let the most intense part of the flame heat the body of the copper, so as to lessen the danger of burning off the tinning on the point. With an electric soldering copper, the heating problem is, of course, taken care of automatically.

If the point has not been previously tinned, the first thing to do is to give it a coating of tin, which really means a

coating of solder. This is done by

lightening the point with emery paper, applying flux in the form of rosin, acid soldering paste, and melting solder over the surface. Then rub the copper quickly on a cloth until the point looks like bright tin. If the copper is ever greatly overheated, the tin will be burned off, and it will have to be retinned.

The first essential in soldering anything is to clean the parts. If the metal is thoroughly cleaned with emery cloth,

file, and scraper, if the iron is hot, if a good flux is used, and if the parts are held so that they cannot move in relation to each other while the solder is being applied, there is no difficulty in making any ordinary soldered joint.

In soldering leaking pots and pans, apply the solder on the inside. If the hole is too large to fill with solder alone, either plug it with a tiny wad of steel

wool or apply a tin patch.

A step in advance of plain soldering is known as "sweating." To make a sweated joint, clean the parts, warm them a little and apply solder and flux till the surface of each is covered with a coating of clean solder. While the solder is still molten, wipe off as much as possible with a rag. This leaves the surfaces covered with a very thin plating of solder. Then bring the joint together and clamp firmly, apply the soldering copper to the joint and hold it until the solder seeps through the other side. Let the parts cool naturally. This makes the

(Continued on page 135)



There Is Still Time to Enter Prize Contest for Best Shipshape Home Ideas

AS THIS issue of POPULAR SCIENCE MONTHLY goes to its regular subscribers and is placed on the newsstands about February 10, there is still time for a good many readers to enter the Shipshape Home Prize Contest announced last month. Letters must be in the office by February 20.

The subject of the contest is "How I Keep My Home Shipshape." For the best letters containing practical, novel, and ingenious ideas on this subject, POPULAR SCIENCE MONTHLY will give a first prize of \$25, a second prize of \$15, and a third prize of \$10, and will purchase at space rates as many other contributions as are available.

Don't simply catalog a number of odd jobs; pick out one or two of your own ideas that have been particularly successful in reducing the upkeep cost of your home.

Keep your letter short—not more than 400 words. Inclose photographs or sketches, if possible, to illustrate ideas.

The winning letters will appear in the June issue. The contest will be judged by the Board of Editors and their decision will be final. Unavailable letters will be returned if accompanied by stamped and self-addressed envelope.

Address Shipshape Home Editor, POPULAR SCIENCE MONTHLY, 225 West 39th St., New York.

The Shipshape Home

(Continued from page 134)

strongest possible kind of soldered joint.

For hardware use hard solder, but for use in connection with jewelry and soft metals, have on hand a piece of soft solder. Soft solder melts at a lower temperature than hard solder. In every case it is necessary to use a solder that melts at a lower temperature than the metal to be soldered. It is not advisable to use acid when soldering tin; use a paste or rosin. Always wash the article thoroughly after soldering so that the soldering won't deteriorate or, as we say in the shop, "rot."

I have often seen amateurs use a soldering copper with a long-drawn-out point, evidently with the idea that it would do neater work. This is a mistake. In my estimation, as such a point will not hold the heat, and unless the work is of such a nature that a blunt point cannot be used, the blunter it is, the better.

Solder will not flow into a joint unless the metal is as hot as the melted solder. It can be heated by passing the copper over the surfaces a number of times after the solder has been applied to the joint opening.

When soldered joints are made outdoors, such as in connection with a radio aerial, it is advisable to paint the soldered parts, in order to check the crystallization of the solder. Thick asphaltum paint is easily obtainable and excellent for this purpose.—HENRY B. LARABY

Stopping Small Leaks

HOT-WATER boilers used in connection with furnaces or gas heaters, sometimes leak at the riveted seam. Calking or patching with the usual repair plugs does not make a permanent repair, especially because of the uneven surface.

An easy method of repairing this type of leak is to make a paste of bran, such as is used for horse feed, into either the top of the hot-water tank or the expansion tank of the hot-water radiator heating system. The bran is so glutinous that it lodges in any small openings in the system and seals them, provided they are not too wide. Such repairs are often as enduring as the remainder of the plumbing work.

After placing the bran in the hot-water tank, it is advisable not to draw any water overnight, to give an opportunity for the leaks to close.—G. A. L.

Laying Linoleum

The edges of linoleum, especially when new, sometimes curl up where two pieces are buttled together. To prevent this and the consequent cracking of the edges, obtain waste curtain cloth, the left overs from window shades, or old discolored shades, and tear in strips about 5 in. wide. Beginning at one end of the seam, place the curtain fabric flat on the floor, with the crack between the two pieces of linoleum in the center, and spread a portion of glue along the top of the curtain strip and on the under side of the linoleum near the edge. After the

(Continued on page 136)



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If a cave man could come out of the distant past to tell you of his prehistoric life—if Columbus could sit in your library and describe his experiences—if Steinmetz and Darwin, Franklin and Pasteur, Archimedes and a host of others whose discoveries have marked epochs in the progress of science were there to talk to you—what amazing things they could tell you! What a fascinating evening you could spend listening to their stories!

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In constructing the table as shown in Fig. 1, a hole should be bored in the top of the legs at the center to a depth equal to half the width of the table rails. The hole should be large enough to receive a bolthead and washer inserted through slot cut diagonally from the hole to the inside edge.

Neither of these tables requires elaborate joinery. As bolts hold the legs and rails

The dowels and slip tongues should be glued only at one end so that the table may be taken apart. The top may be fastened to the rails with screws, strips, or iron plates.

Hardwood blocks are glued and screwed to the tabor rails, and either stair-rail or ordinary bolts are used to connect the parts. One bolt through each block at the top is sufficient; a heavy wood screw will serve for the bottom fastening.

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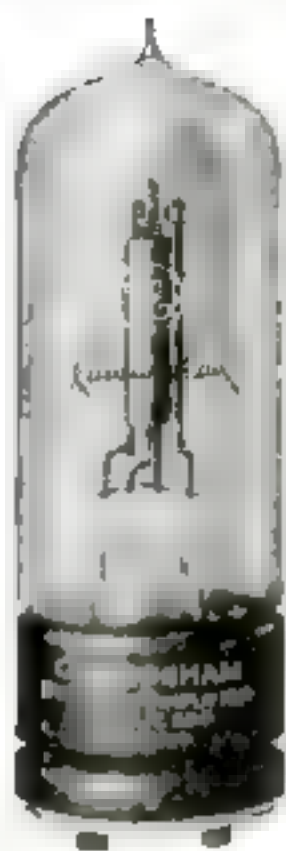
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for Radio Receiving Sets



Cunningham Radio Tubes

C-292A—5 Volts 1.4 Amps
Max. Int. \$6.10
200 5 Volts 0.6 amp. Dry
Battery Det. and Amp. \$6.50
300 5 Volts 1.0 amp. Dry
Detector \$5.10
1-11-1 5 Volts 1.5 amp. Dry
Battery Det. and Amp. \$6.50
Special Base \$6.50
1-2 Similar to C-12 with
standard base \$6.50

PATENT NOTICE

Cunningham tubes are covered
by patents dated 11-7-25
1-18-27 3-18-28 and other
dates and pending. Licensed
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communication. All other use
will be an infringement.

CUNNINGHAM Radio Tube Type C-292 is a Detector and Amplifier of the high vacuum type, designed especially for dry battery filament current supply. The special filament in this tube draws a current so low that as many as four tubes may be readily operated from a single set of three cells and No. 6 dry cells. The ideal tube to use in your set.

The care and operation of each model of Cunningham Tube will be explained in our new 140 page Radio Tube Book. This free book may be obtained by sending ten cents to our San Francisco office.

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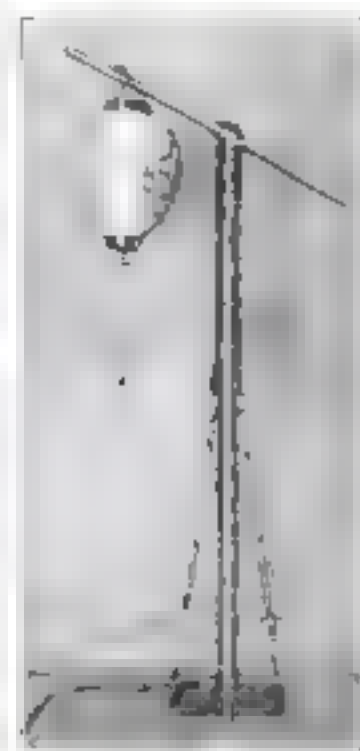
Framework Covered with Putty Forms Unique Floor Lamp

THAT an inexpensive and artistic floor lamp can be made mainly of putty seems absurd, yet the lamp illustrated was built in that way and it has been in use for more than six months. The putty on it is thoroughly dry and as yet it has not cracked nor fallen off.

The materials needed to make such a

lamp are 7 pieces of wood, a lamp socket and plug, 10 ft. of lamp cord, a few nails, 25 cents' worth of shellac, 85 lbs. of putty, about 10 cents' worth of gilt or paint, and a Chinese lantern.

The wood can be rescued from almost any trash heap. It does not matter whether it is surfaced or rough, although putty sticks best on the rough. The shellac makes the putty stick



The lampstand is covered with putty

to the wood better. Paint only a small surface at a time and apply the putty before the shellac dries.

If the putty is worked into the wood by hand, the dents left by the fingers give the lamp an odd finish. The putty will not harden for some time, but the lamp may be finished, gilded, painted, or touched up, as the maker sees fit, and used immediately, provided it is not roughly handled.—W. C. HAZEL, Hollywood, Calif.



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Tool Racks Made from Old Cartridge Fuse Clips

DISCARDED cartridge fuse clips from old switchboards are to be found in the scrap box of almost every electrical repair shop. These may be made into excellent tool holders for the shop or used in the home to hold kitchen utensils.



CARTRIDGE FUSE CLIP
For holding tools

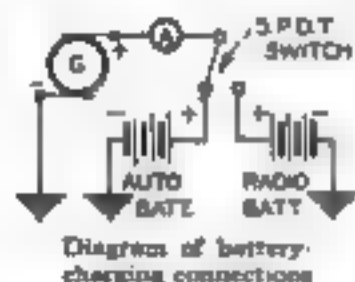
All that is necessary is to remove the two little ribs or stops that ordinarily retain the end of the fuse in place.

This can be done quickly by bending them back and forth with a pair of pliers and then filing off the rough spots where they break. The clips are then fastened to the wall or bench backboard with screws. The sides of each clip may be bent to fit the particular tool it is to hold.

A row of these clips forms a very neat rack for holding sets of bits, chisels, carving tools, and the like. They may be used equally well on the bench backboard or in a tool cabinet. S. W. B.

Using Your Car to Charge a Radio-Storage Battery

IN CHARGING the A battery of my radio set, I use my automobile generator. A single-pole double-throw switch is inserted in the charging circuit between the ammeter and the regular car battery, one lead going to the car battery and the other lead to any point in the car



where the radio battery may be carried. To charge one or the other battery is then a simple matter of changing the switch. Care must be taken,

however, that the car battery switch is closed when the radio battery is not in the circuit.

If the brushes of the generator are set up to charge from 12 to 16 amperes, and if not a great deal of night driving is done, one will find that by this system both batteries will be kept charged and in good shape.

The generator must, of course, be of a 6-volt type, and both batteries of the kind used for autos. A battery made especially for radio work cannot be charged at so high a rate.—DALLAS BOUDEMAN, Jr., Kalamazoo, Mich.

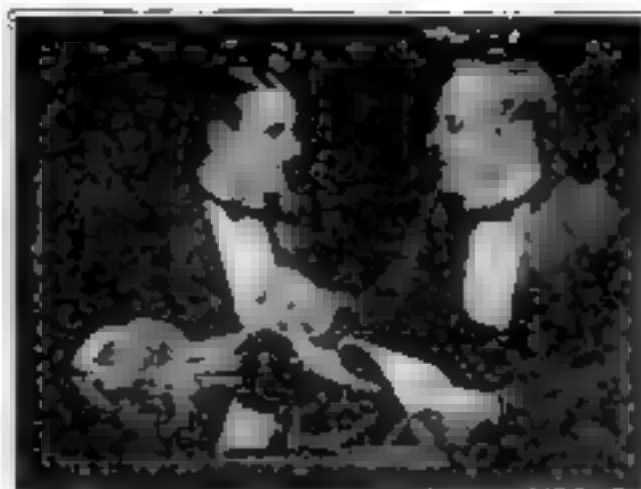
Drawing Ink Flows Freely in an Ordinary Fountain Pen

ALTHOUGH it is generally believed that India ink cannot be used in an ordinary fountain pen, I have been writing and drawing with drawing ink from the same fountain pen for more than a year. The secret lies in keeping the ink flowing. When not in use, the pen is placed in a corked test tube containing a little water. Don't change from regular writing fluid to India ink, however, without first giving the pen a thorough washing.—N. G. NEAR.

Walking on Auto Tubes

SHOES and auto tubes can be kept in repair, sometimes into the third year, by being re-soled with rubber from old auto tubes. It takes only a few minutes to resole a shoe; in fact, three pairs can be repaired in an hour at a cost for materials of only a few cents a pair.

The air-cured cement now sold is such an improvement on the cements of a few years ago that the rubber soles can be made to stick very well. A thin fabric or repair gum for bicycle tire repairing, which has both surfaces prepared to unite with air-cured cement, is used as an interlayer between the old tubing and the soles of the shoes. The other materials necessary are coarse sandpaper to roughen the rubber surface, a small wood rasp to roughen the leather, a pair of shears, a sharp knife, a light hammer, a file, and nippers for cutting nails.—E. A. WADSWORTH, Grand Forks, N. D.



Why Teeth Discolor

Tobacco, food, etc., stain the film

THE clouds on teeth lie in the film-coats. The remedy is to remove the film. Millions now daily combat the film, and the glistening teeth you see everywhere show what it means.

You must fight film

Film is that viscous coat you feel. It clings to teeth, and no ordinary tooth paste can effectively combat it.

Soon it becomes discolored by tobacco or by food, then forms a dingy coat. That is how teeth lose their beauty.

Film also holds food substance which ferments and forms acid. It holds the acid in contact with the teeth to cause decay. Germs breed by millions in it. They, with tartar, are the chief cause of pyorrhea.

Under old methods very few escaped these film-caused troubles.

PROTECT THE ENAMEL

Pepsodent disintegrates the film, then removes it with an action far softer than enamel. Never get a film-coat which troubles again.

Now dental science has found two ways to fight film. One disintegrates the film, one removes it without harmful scouring.

These methods have been well-proved by able authorities. A new-type tooth paste has been created to apply them daily. The name is Pepsodent.

That tooth paste has come into world-wide use, largely through dental advice.

Watch them become whiter

Every use of Pepsodent also multiplies the great tooth-protecting agents in saliva. These combined effects have brought to multitudes a new dental era.

Send the coupon for a 10-Day Tube. Note how clean the teeth feel after using. Mark the absence of the viscous film. See how teeth become whiter as film coats disappear.

You will be glad to know a method which brings results like these. Cut out coupon now.

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Invention is the easiest way to earn a fortune. Little ideas have made millions of dollars for their inventors. This wonderful book explains how fifteen famous inventors now teach you the secrets of successful invention—in your own home.

HOW would you like to be the inventor of the *Tea-Safe Safety Razor* who makes **TWO AND ONE HALF MILLION DOLLARS** a year? Wouldn't you gladly be the inventor of the *Zip Fastener* whose profits were so big that he paid an *income tax* of \$2,000? Well, isn't you valiantly change places with the inventor of the *President Suspenders* who is now worth \$5,000,000 or the inventor of the *Autographic* attachment for cameras who sold his patents for \$400,000?

One single idea as simple as any of these—can make you inexplicably wealthy in a short time. Other inventors have made thousands of dollars from such common things as the *crinoid hair-pin*, the *metal tip shoe-lace*, the *paper safety match*, the *ordinary wire paper clip*. These are certainly not complicated inventions—they are so simple in fact, that probably thousands of people thought of them but only *one* man DID anything about the idea when it came to him.

Ideas Worth Fortunes

Every day you find ideas for new inventions. It may be a new toy for your children. The man who invented the *Kiddee Kar* is reported to have made over \$5,000,000. It may be a new kind of soap. *Lifebuoy* is worth millions of dollars today. It can even be a new kind of broom to make housework easier for millions of housewives. But no matter what it is—if your idea is practical, if it solves a problem, if it satisfies a need—a fortune may be waiting for you.

Perhaps even now you have splendid ideas for inventions but the only reason you have not developed them is because you doubt your own ability to invent. Or, like most persons, you believe that you were not born to be an inventor; that inventors are men who invent things as naturally as other people

work as bookkeepers, mechanics, doctors or farmers.

Proof YOU Can Invent

Invention is not guesswork or blind luck—it is not a fixed given factor possessed by a few selected mortals. As a matter of fact inventors themselves say that invention is based upon exact laws which anyone can learn. It is merely a matter of first seeing something to be fixed and then of thinking of a principle which will fix it. That is all—that is everything to invention. Brought down to its plainest definition, invention is merely the science of 'fixing things.'

And how many times a day you "fix things." A leaky faucet, a rattling window, a wobbly table—you fix hundreds of things like these every year. And, though you may never have realized it, every time you "fix things," you use the very definite exact principles which are the basis of Inventive Science.

What Edison Says

Could you ask the advice of any greater authority than Thomas A. Edison? He says: "*Invention is a Science and should be taught as a profession.*"

And now for the first time, you can actually learn invention as a profession—exactly as other people are learning electricity, mechanics, law, medicine. It doesn't matter who you are or what your present work is. With no special knowledge of mechanics or science you can learn how to invent!

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need to become successful is this easy, fascinating training which will develop your ability as it will be worth real money. No special technical or mechanical knowledge or experience is necessary. Fifteen famous inventors tell you the secrets of invention, which every successful inventor knows. They explain how to originate ideas, how to develop and perfect them, how to get patents. But they tell you even more. Thousands of inexperienced inventors have been defrauded of their rewards because they did not know how to protect their patent rights. This great course tells you everything you want to know—how to sell your invention, how to get royalties—how to get the most money for your ideas.

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The most interesting part of this wonderful course is that it teaches invention by actual practice right in your own home. With each lesson you are sent at least one practical problem in invention. This absorbing exercise in solving actual inventive problems sharpens your intellect to fix things. Better than anything else it gives you an unforgettable, natural, free habit of thinking inventively which is worth more than you realize. In fact, the lessons and exercises are so simple, so easy to understand, so interesting that they seem more like a pleasant game than like instruction which can make you a successful inventor.

A wonderful new book, just printed, tells you more about the Bureau of Inventive Science and its simple new course in invention. It costs nothing so send the coupon at once. This bureau is not connected with patent attorneys or manufacturers. Its only purpose is to teach you the principles of practical invention used by every successful inventor. Write for the FREE BOOK now. It may show you the way to make a fortune.

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Four Successful Landon Students From One Village

Here is the record of four boys—all from Naperville, Ind. 2200 population—who, after taking the Landon Course, won national reputations.

Merrill Blumer is now nationally famous as creator of "Freckles and his Friends."

Henry Maut's work appears in Saturday Evening Post, Cosmopolitan, etc.

Freddie Parks, following their advice, is now a cartoonist for the Omaha News.

Fred Nelson is comic artist with the Universal Feature Co.

Swinging Shelf in Garage Holds Tools for Engine Repairs

VALVE regrinding, decarbonizing and other auto-engine repair work can be speeded up surprisingly if a shelf bench is made for the home garage, as illustrated. The tools are arranged on this board in



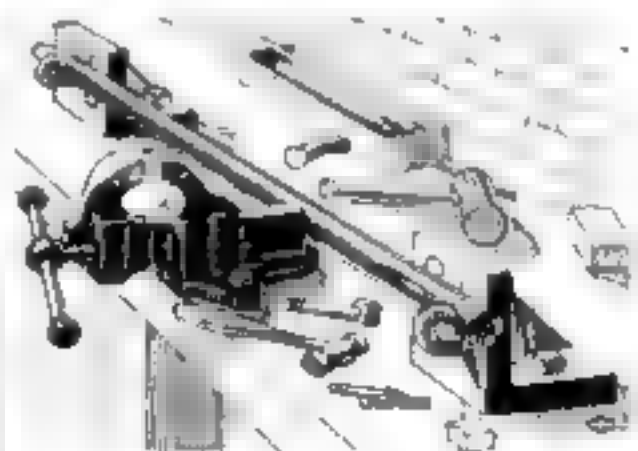
Tools for tuning up the engine are immediately available on this folding shelf

holders or strap pockets so that they are instantly available. The shelf is hung in the forward end of the garage, adjacent to or under a window if possible. The height when lowered is enough only to clear the radiator of the car.—G. L.

Vise Provides Pressure for Simple Bench-Straightening Fixture

IN STRAIGHTENING parts on the bench it is customary to use the vise to grip one end of the part and bend or press the other end with the fingers. This is a slow and tedious process. The method illustrated is the use of the straightening fixture illustrated. It is used mainly in automobile repair work, but it is generally serviceable.

In the rear of the vise are two small angle plates bolted to the bench top. The



Held against two angle plates, the bent part is straightened by the vise ram

faces of these plates are drilled with holes for hook bolts, which are used to hold against turning the parts to be straightened.

The work is lined up and fastened so that the screw or ram of the vise will bear against the center of the bend. The controlled pressure of the vise screw makes it possible to use a straight edge or other means to test the work. Irregularly shaped parts, such as crankshafts, camshafts, connecting rods, and parts of an auto's steering mechanism, can be straightened advantageously in this way because the bench top provides a clear, flat surface for blocking and testing.

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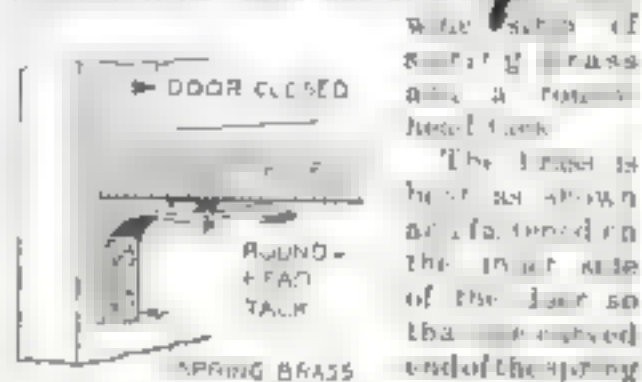
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Simple Spring Catch Holds Cupboard Door Shut

CUPBOARD and cabinet doors frequently close and stay shut. This is due to a spring catch that is both simple and strong. Such a catch may be made in a few moments' time out of a steel wire strip of spring brass and a round head tack.



The catch engages a round head tack.

The brass is bent as shown and fastened on the inner side of the door so that the end of the spring engages lightly the inner side of the main shelf.

The round head tack is driven into the bottom side of the shelf in such a position that the spring will slide over it and snap into place. The door is then closed, but still it can be opened readily.—S. W. H.

Rubber Cap for Screw Driver

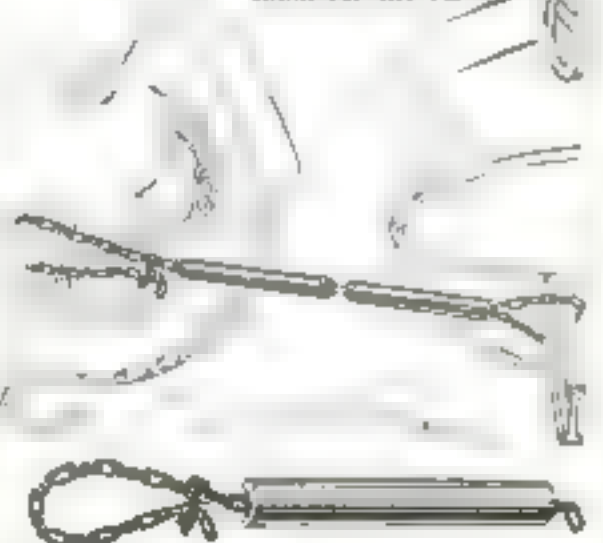
ON MY mind was a screw driver which I had used many times. It was shown to me also for friction in the grip of the hand. A small rubber cap hole is drilled in the end of the handle and a rubber-head tack is driven in. Working the tack around a few times will make it turn freely.

This scheme makes a straight screw driver work almost as well as a nut driver, providing a cushion for the palm of the hand.—W. T. M.

Wrought-Iron Pipe Improves Emergency Towing Chain

WHEN a short chain is being used for towing a car, it is often found that the chain is not strong enough to pull the car out of the mud. This method was devised for towing a car stranded in the country where the

The pipe makes possible the use of a short towing chain for the car.



longest chain available was a trace chain. This was so short that the brakes were ineffectual, but by placing a section of wrought iron pipe, about 10 ft. long, over the chain, the tow of more than 20 miles was made without an accident.

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How to speak and write Masterly English

Thousands of people make little mistakes in their everyday English and don't know it. As a result of thousands of years of use, a Sherwin Cody found that the average person is full of little errors in the way he speaks. In a five minute course, or in an average one page letter, from five to ten errors will appear. It is surprising how many experienced stenographers fail in spelling such common words as "quadrant," "abbreviate," etc. It is astonishing how many business men say "between you and I" instead of "between you and me," and use "whom" for "which" and "where" in the simplest words. Few people know when to use one or two "s" in "is" or "are," whether to spell words with "the" or "th," and when to use commas in order to make their meaning absolutely clear.

A REMARKABLE INVENTION

Mr. Cody has specialized in English for the past twenty years. But instead of going along in the old way he has applied scientific principles in reaching the correct use of our language. He made one of thousands of tests of his various devices before inventing his present method. In all his tests he found that the trouble with old methods is that pupils learned to do not stick in the mind. In school you were asked to remember rules and if you forgot the rules you never could tell what was right and what was wrong. For many years Mr. Cody has studied the problem of creating inductive habits of using good English. And as a result of his experience he evolved his wonderful new

SELF-CORRECTING METHOD

A patent was granted Mr. Cody on his unique device, and now he places it at your disposal. This invention is simple, fascinating, time-saving, and incomparably efficient. You do the lesson given on any page, then you see exactly how Mr. Cody himself would correct it. You mark your errors and check them in the first blank column. Next week you try that page again on the second marked sheet, correct your errors, and check them in the second column. You see at a glance what you have learned and what you have failed to remember until you have reached the 100% point in spelling, punctuation, grammar, and expression.

ONLY 15 MINUTES A DAY

A remarkable advantage of Mr. Cody's course is the speed with which basic habits forming practice can be carried out. You can write the answers to fifty questions in 15 minutes and correct your work in five minutes more. You waste no time in going over the things you already know. Your efforts are automatically concentrated on the mistakes you are in the habit of making, and, through constantly being shown the right way, you soon acquire the correct habits in place of the incorrect habits. There are no rules to remember. There is no tedious copying. There is no heart-breaking drudgery.

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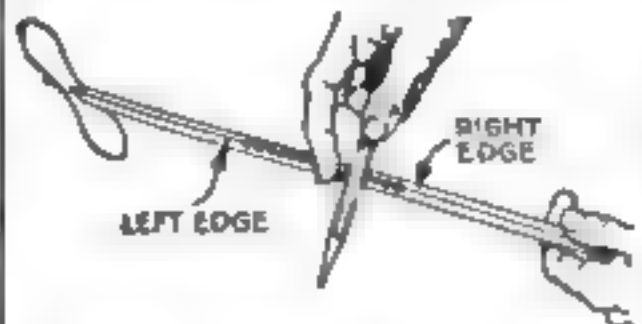
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Trick Toy Propeller Mysteriously Reverses Its Revolution

RUB the notched stick of this puzzling little toy and the propeller wheel will spin in one direction. Keep on rubbing and it will suddenly stop and begin to spin the other way—that is, if you know the secret of the toy.

The propeller itself is simply carved from a stick of soft wood three or four in. long. It is mounted by means of a small nail on the end of a thin square stick, preferably hard wood, twelve or



How the propeller revolves depends upon whether the left or right edge is touched

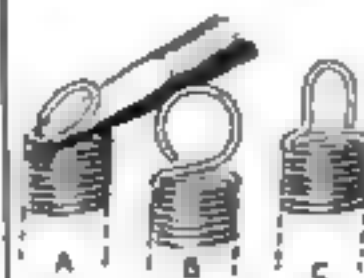
15 in. long. Along one edge of the stick a series of notches are cut, as shown.

To operate, hold the propeller stick horizontally by the extreme end and rub the notches with a pencil or other stick, at the same time pressing lightly with the forefinger against what is marked in the illustration as the left edge. To change the direction of revolution, lift the forefinger away from the left edge and press lightly against the right edge with the thumb. This can be done without noticeably altering the position of the hand or fingers, so that very few observers will see what has caused the propeller to change its direction.—WALTER MARKOWSKI, Camden, N. J.

Shortening a Steel Wire Belt

STEEL wire belts—that is, belts consisting of a long coil of spring steel wire—can be easily and now that it is a good thing to know how to shorten or join them.

Cut off the belt, when it is to be shortened, by forcing the blades of the wire cutters between the coils and snipping straight through. Insert a small screw-driver under the first loop (A) and pry it up until it can be seized with a small pair of pliers. Bring up the loop with the pliers until



Steps in forming the connecting loop

it is upright, and then twist it around so that it extends diametrically across the coil (B). The loop must be bent up at such a point that the end of the wire will allow the loop on the other end of the belt to hook in, yet make the opening no larger than necessary (C).

Steel wire belts do not work well unless they fit closely in the grooves of their pulleys. Put such a belt on a pulley designed for a round leather belt, and it will slip and be practically useless. In a pulley with sharply pitched flanges, it can wedge itself in firmly.

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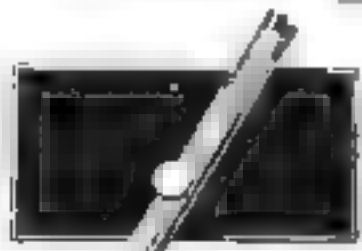
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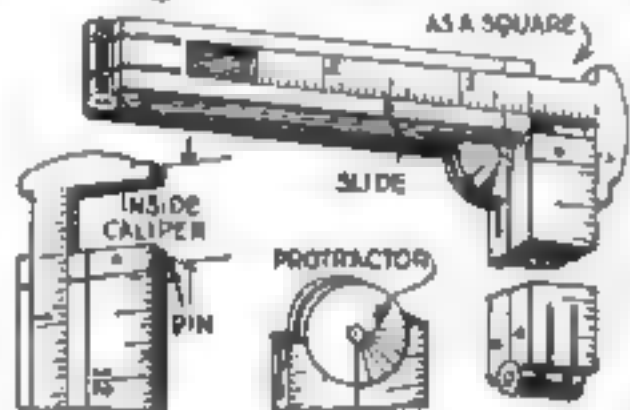
shape shown with a fine nib and a coarse nib or varying slip. The pen can still be used for ruling straight lines.

ALTHOUGH there are many kinds of lettering pens on the market, an exceptionally useful one can be made in a short time from a regular draftsman's ruling pen. The point is altered to the

Improving a Pocket-Caliper Rule

IN SPITE of the steel rules and combination outfits in my possession, my most useful tool is a small one-foot, fourfold, wooden caliper rule. Together with a steel tape, it is always with me.

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How the rule is used as a square, protractor, and inside caliper

width and inserting a small pin, as shown. This allows the rule to be used as an inside caliper.

In addition, I have marked off the major angles on the principal hinge, and this enables me to measure angles within a fair degree of accuracy. By opening the rule at right angles, the caliper head serves as a guide in making a serviceable square, and the caliper portion can be removed and used when necessary as a depth gage. —E. J. MORRISSEY, West Allis, Wis.

Washers Used to Fix Uneven Legs on Movable Furniture

A PORTABLE workbench we were using about the garage became somewhat wobbly because one of the legs had shrunk until it was shorter than the others. To avoid the work of removing the rollers or casters from the other three legs and sawing them off, we simply placed a washer, as shown, above the roller on the short leg. This is the simplest possible way of making such an adjustment on furniture having casters and saves much trouble. —G. A.



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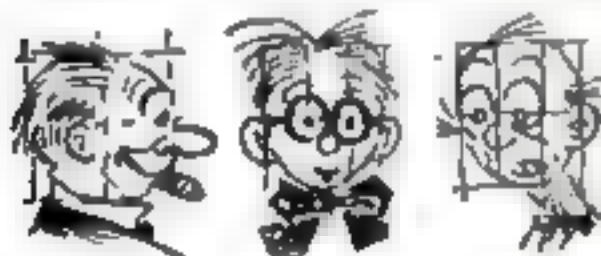
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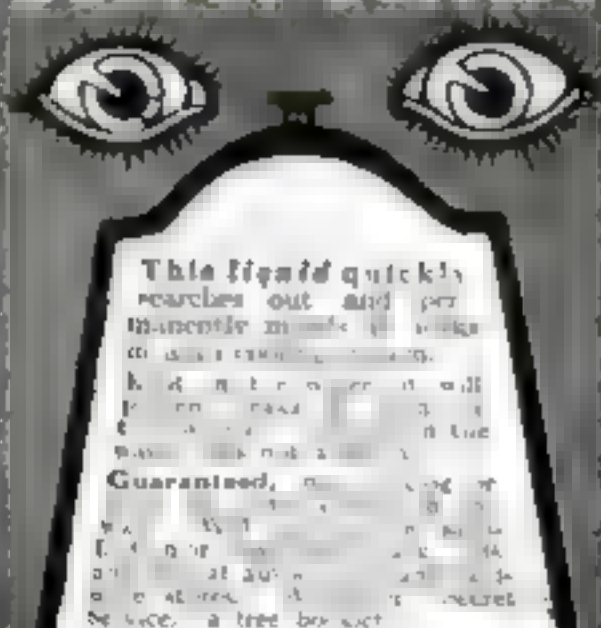
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Neutrodyne Set

(Continued from page 73)

condensers, the two jacks, and the two rheostats. Then drill holes for the seven binding-posts (if you desire them on the front of panel). Also drill the proper holes for fastening the tube sockets and the rheostats and for fixing the panel to baseboard.

The holes used for fastening the variable condensers are the most important and should be located with the greatest possible accuracy. The purpose of mounting them at the 55-degree angle shown in Fig. 1 is to prevent interaction between the currents in the coils that are attached to the backs of the condensers. Deviation from the true angle by more than a degree

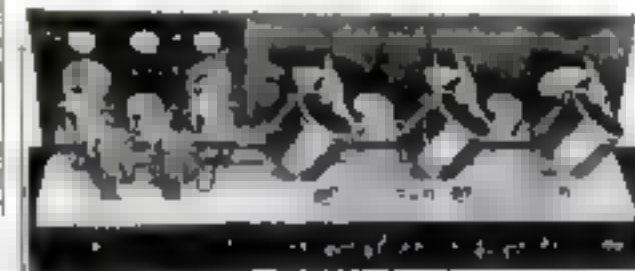


Front view of panel with tuning dials

is likely to result in objectionable oscillation. Fortunately the angle is independent of the distance from center to center of the coils.

Next, cut the sheet copper to size and drill clearance holes as indicated by the dotted lines in Fig. 1. This shield is not absolutely necessary for every receiver, but it always will be an improvement, since it does away with bothersome body-capacity effects. In some receivers that have come to the writer's attention, shielding of some kind was absolutely necessary, for the reason that the neutralizing condensers could not be adjusted to small enough capacity if the shield were absent—i.e., the receiver was over-neutralized, due to inherent capacities between condensers and coils of adjacent stages.

The shield then can be fastened to the panel. The tube sockets D and E will



Rear view of panel showing three special neutrodyne tuning elements, called "neutroformers"

hold it securely at the bottom and several flat-head machine screws with nuts are sufficient to hold it at the top. Next, mount detector-tube socket F and amplifier-tube sockets G and H. The condensers and coils (neutroformers), A, B, and C, then should be fastened. Examination will show that each transformer has an outer coil about two inches in width and an inner coil about one half inch in width that is placed toward one end concentric with the outer.

The outer coil is provided with a tap about half an inch from the end where the primary or inner coil is placed. The complete units, A, B, and C, should be mounted so that the primary or inner windings are at the upper left (when viewed from front of panel). It is possible to mount the coils so that they all

(Continued on page 147)

Neutrodyne Set*(Continued from page 146)*

along the other way, but this necessitates longer connections.

After mounting the rheostats, jacks, and binding-posts as indicated in the sketch (P, Q, N, O, from 39 to 45 inclusive), the wiring may be commenced. The connections first described are those that carry relatively large radio-frequency currents or are at relatively high radio-frequency potentials. They should be as short as possible and at the same time be kept as far as possible from other wires.

Details of Wiring the Set

Referring to Fig. 1: From antenna binding-post 39 run a lead to point 1, a connection on the inner coil of unit A. From 2 run a lead to ground post 40. Then run leads from 3 to XPD (negative filament of tube D), and from 4 to GD. Connect shield at 38 with ground post 40. From PD proceed to 5; from 7 to -FE; from 8 to GE; from PE to 10; from 12 to +PF; from 13 to 19, from 20 to GF; from PF to 46; and from 46 to 37. (Note that condenser T may be placed to better advantage to the right of and under tube F.) With the exception of the leads to the neutralizing condensers J and K, this completes the first group of connections.

The second group includes the low-potential connections, that is, those at low radio-frequency potential. They include the connections that supply the tubes with the direct current and the connections of the audio-frequency stages. In this group the battery connections should be bunched and well insulated to prevent short circuits, while the audio-frequency transformer connections should be short and isolated as much as possible.

The negative filament bus wire begins at the ground connection 2-40 and connects successively -PD, -FE, -FG, -FH, and finally the 6-ohm rheostat Q at point 23. It should be noted that this wire does not connect with -PF on the detector tube.

The positive filament bus starts at +PD, is joined to plus A battery, post 41, and then continues to +PE, +FG, and +FH in order. A connection also is made to the detector-tube rheostat at 21. Connect also from negative A battery post 42 to -PF, to 44 (negative B battery post), to 47 and to rheostat at 24. This connection is termed the "negative battery lead."

How to Mount the Transformer

The positive B battery lead starts at 6, is connected with by-pass condenser R at 48, proceeds to point 11 on unit C and ends on jack O, point 25. A connection is made also from this bus with the proper post at 45. Connect 49 with negative battery lead. The positive detector B battery lead starts at 43 and proceeds to 26.

The next step is to mount the audio-frequency transformers in their proper relative positions on the baseboard. The connection 34 to positive B battery lead should be soldered first at the lead, with the end 34 free. This applies to connections 25 to 30, 26 to 31, 33 to negative battery lead, and 37 to 24. Points 25, 26,

(Continued on page 148)

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Neutrodyne Set

(Continued from page 148)

1. Remove tube D from its socket and place a piece of paper over one of the filament prongs (see Fig. 3). A good way to do this is to make a small hole in a piece of paper, put the prong through it, and double the paper back over the bottom. This holds the paper on when removing the tube.

2. Replace the tube, which now does not light up, and retune the dial if necessary. The signal now will be much weaker and the telephone plug should be shifted to the amplifier jack.

3. Adjust the neutralizing condenser J by sliding the metal tube until no signal, or at least the weakest possible signal, is obtained. This adjustment is very important and the experimenter should be sure that he actually has obtained a balance. One check is to see whether, when the tube is removed entirely and dial A is retuned, the signal again becomes loud, as it should. Also it should be possible when adjusting J to actually pass through the minimum and bring the signal up to moderate intensity by continuing the motion of the sliding tube. If this is done, the tube should be returned to the position of minimum signal before continuing.

4. Remove paper from prong of tube D and replace that tube.

5. Remove tube E, place paper on one of its filament prongs, and replace the tube in the socket. Again retune for maximum signal.

6. Repeat operations 3 and 4 with respect to condenser K, dial B, and tube E.

Receiver Should not Oscillate

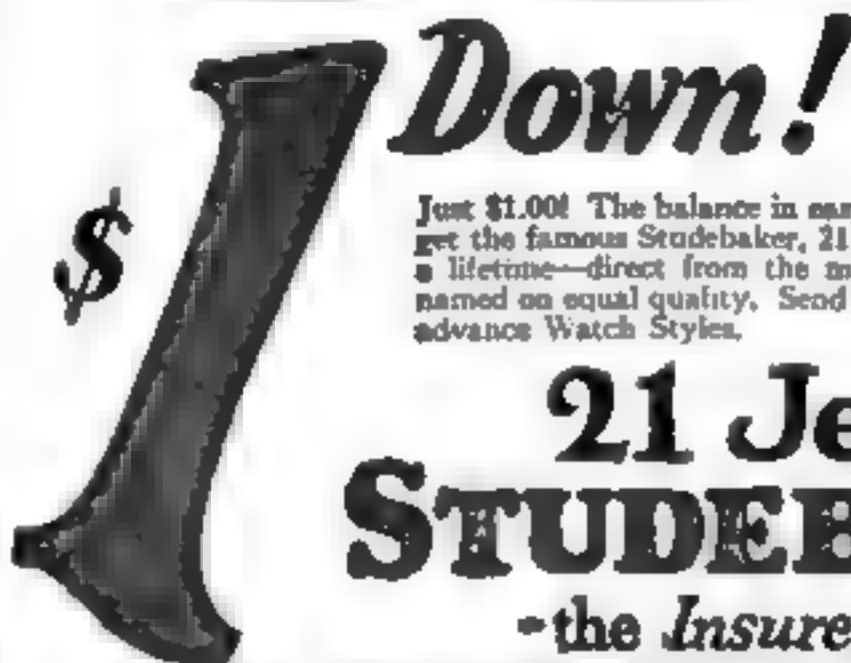
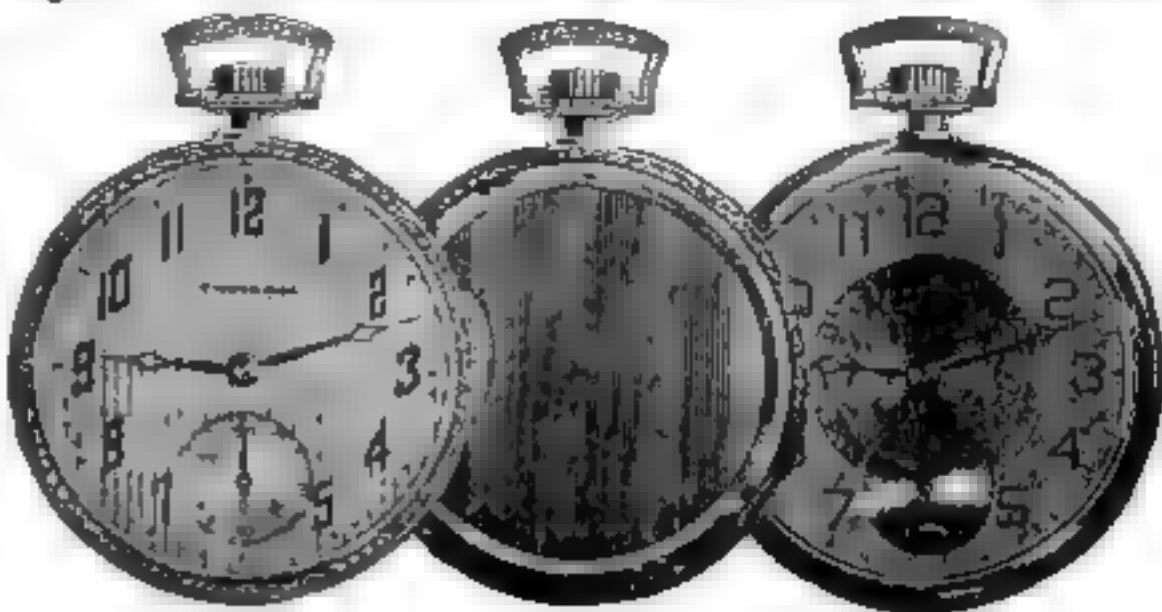
The receiver now is completely adjusted and ready for use. It should not oscillate and should produce no beat notes or whistles with incoming signals. To receive other stations the best procedure is to move both dial A, B, and C a few divisions in the same direction. When all three circuits are in tune, a rushing sound will be heard. This noise is called "background," is unavoidable, and is noticeable only in very powerful amplifiers. It is due to atmospheric disturbances such as spark stations.

Continue to move all three dials, B and C first, then A, until the desired station is picked up. Once having heard a given transmitter, the dial settings may be recorded for future reference. Since the settings of dial A and B and C are independent, there will be only one combination of the three dial settings that is correct for any particular wave length.

On local stations the relatively strong signals may be amplified to such an extent as to overload the detector and amplifier tubes. This causes distortion. A remedy is to use a smaller antenna or, if this is not convenient, to detune one of the dials, preferably A, until a good quality tone is obtained.

In this article nothing has been said about the theory underlying the operation and adjustment of the neutrodyne receiver. If the reader is interested, he may refer to Proceedings of the Radio Club of America for March, 1923, also published in "Q & T" for April, 1923.

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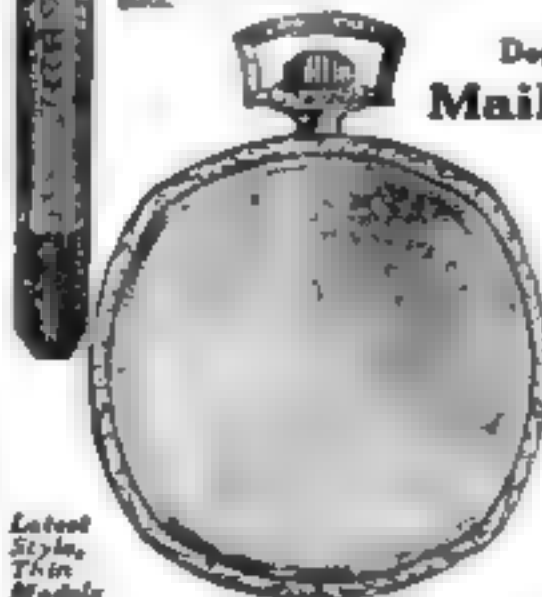
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Perils of Polar Flight

(Continued from page 33)

landing requires either a shed or a mooring-mast, or what is called a "three-point mooring." The latter means simply using several hundred men to pull the big ship down out of the sky. Thus, landing by dirigible would be out of the question if a new continent were discovered in the Polar Sea.

This brings us to the most important problem of all—that of rescue in case of disaster. No battle is properly planned that does not leave open a line of retreat. No arctic expedition is sanely prepared that does not provide a means of escape for its members who may get adrift.

A generation ago the United States Government sent out the Greeley expedition to North Greenland and across to Ellesmere Land. It was the best-equipped arctic party that ever had been fitted out. Yet it ended in a tragedy that shocked the country.

The reason for that disaster lay in the fact that lines of retreat were not arranged for in proper detail. There was lack of information about arctic travel; confusion of instructions; misunderstanding of agreements. At Cape Sabine men died by starvation with plenty of food at hand. They didn't know how to get it. Thirty years later at the same Camp of Death, the writer and four Eskimos killed and cached two tons of walrus at the very same time of the year that the last three deaths in Greeley's party occurred.

The Difficulties of Rescue

This is not criticism of that unfortunate expedition. The tragic facts are recalled simply to emphasize the almost insurmountable difficulties of this phase of arctic exploration.

Suppose, for example, that the three planes with which the explorer Amundsen is planning to make a polar flight, enter fog just past the Pole. With a poorly directed compass one pilot shifts to the right of his course. His radiator develops a leak, and he is forced down. On landing, he smashes his plane in rough ice. He has food for a month and clothing.

What plans could have been made to find and rescue him?

Briefly, it would take 20 of our best planes working for nearly a month from Point Barrow over 1000-mile lanes to cover properly all the area in which the unhappy man might be stranded. If he should have barely passed the Pole, we should have no plane that could be counted on to rescue him. He could not possibly make land with what equipment he might carry in his plane. Also, during the search, other aviators might get themselves in just such a jam as he would be in.

A dirigible might make a better search. But even a dirigible working from Point Barrow would have to have a mooring mast there. She would be held up by storms. Sleet might drive through her thin envelope and tear one or more of her balloonettes from which would escape the precious helium.

And don't forget that Point Barrow, the supposed base for such rescue work, cannot even be reached by ship to establish—

(Continued on page 151)



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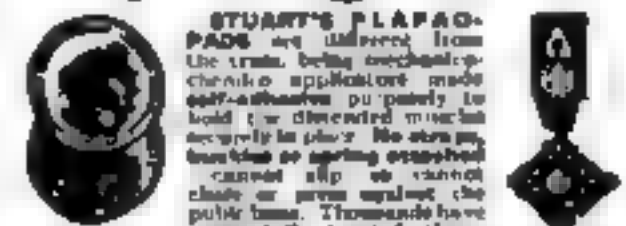
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STUART'S PLASTER-PADS are different from the truss, being made of a special adhesive material. They are applied to the back of the truss, holding it in place. No straps, buckles or springs attached. Cannot slip or catch. No chafe or pain against the skin. Thousands have successfully treated their hernia at home without expense or loss of time. Reduced the hernia from a painful, dangerous condition to a harmless one. Guaranteed. Awarded Gold Medal and Grand Prize. Proven of recovery in 10 days, no afterwards no further use for truss. We prove it by sending Trial of Pads absolutely FREE. Write name on Coupon and send TODAY.

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Name _____
Address _____
Return mail with Free Trial Pads.

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Is up the ears what glasses are to the eyes. Invisible, unobtrusive, perfect. Write for booklet and brochure. THE MORLEY CO., Dept. 707, 80 N. 2nd Street, Philadelphia.

Sore throat

Combat it both inside and outside. Use Absorbine-J as the soothing, healing, germ destroying, antiseptic ointment. Apply it outside to break up congestion, draw inflammation and reduce swelling.

All drugists \$1.25 or postpaid. Liberal trial bottle one postpaid. W. F. YOUNG, INC. 250 Lyman St., Springfield, Mass.

Absorbine-J

THE ANTISEPTIC LINIMENT

for Sore throat, Sore eyes, Sore ears, Sore nose, Sore mouth, Sore skin, Sore feet, Sore hands, Sore back, Sore neck, Sore chest, Sore stomach, Sore bowels, Sore bladder, Sore prostate, Sore uterus, Sore vagina, Sore anus, Sore rectum, Sore colon, Sore small intestine, Sore large intestine, Sore stomach, Sore bowels, Sore bladder, Sore prostate, Sore uterus, Sore vagina, Sore anus, Sore rectum, Sore colon, Sore small intestine, Sore large intestine.

There's fun in making tobacco that brings such letters

The man who has found the right job, the right wife, and the right smoking tobacco has little reason to envy his fellows.

And some Edgeworth smokers write us as though the most important thing in life were the right tobacco.

We imagine that is because the right tobacco does make even the rightest job and the rightest wife seem a little bit righter.

That's why we enjoy making Edgeworth; and here's a letter from a seventeen-year Edgeworth smoker.

Larus & Bro. Co.,
Richmond, Va.
Gentlemen:

Norfolk, Va.

Permit me to toss my hat into the Edgeworth ring.

I have always admired the modest tone in which you touch on the merits of your tobacco. Instead of advertising it as the best pipe smoke on earth—a fact I believe it is.

Seventeen years ago my father saw a friend filling his pipe from a tin of Edgeworth Slice and asked for several slices to bring home to me. It is worthy of note that the package was attractive enough in itself to excite my father's interest in the first place but when I told that, so far as I am aware, he never used tobacco in any form during his entire life. It is still more remarkable.

Up to that time I was a member of the "Tried 'em All Club." Can I put any more steam behind this testimonial than to say that for seventeen years I haven't spent a dollar for any pipe tobacco other than Edgeworth. The Ready-Rubbed is a word of smokers enjoys my respect, but for me—give me Edgeworth Slice. Brother, it's a man's smoke and it stays with you!

Long may you make it and long may I smoke it.

One of your boosters,
E. P. Chapman,
1407 Umohandro Ave.

If you haven't tried Edgeworth, send us your name and address and we will immediately forward to you generous helpings of both Edgeworth Plug Slice and Ready-Rubbed, with our compliments.

For the free samples, address Larus & Brother Company, 69 South 21st Street, Richmond, Va. If you will also include the name and address of your tobacco dealer, it will make it easier for you to get Edgeworth regularly if you should like it.

To Retail Tobacco Merchants: If your jobber cannot supply you with Edgeworth, Larus & Brother Company will gladly send you prepaid by parcel post a one- or two-dozen carton of any size of Edgeworth Plug Slice or Ready-Rubbed for the same price you would pay the jobber.

Habits Make or Break Us

(Continued from page 39)

pulses flow more and more easily as time goes on. This process is true of good habits and bad habits alike. It requires some persistence to form a habit, but once the habit has been formed, it cuts so deep a groove that breaking it is something that only persons of exceptional will power succeed in doing. And a good habit is as difficult to break as a bad one.

Only a few weeks ago I astonished a New York business man by opposing his desire to bring about the retirement from business of his father, who is more than 80 years old. For 65 years this old gentleman has been rising at six in the morning, hurrying to his office, and working through the whole day as hard as his most ambitious young employee. Undoubtedly he has earned his retirement, but, as I told his son, to begin it probably would be fatal. The habits of a lifetime are not to be thrown aside so lightly.

There is nothing heroic about this old gentleman's devotion to business. He is in the grip of a habit as necessary to his well-being as food and sleep. Rest for him, as for others who are addicted to the praiseworthy habit of hard work, would be a dangerous experiment.

Life means activity, and when we cease to be active, the life force runs down in us. Few people ever have died of overwork, but the victims of inactivity are countless.

How to Direct Habits

It has been well said that if we acquire a sheaf of good habits, there will be little time or energy left in our lives for bad habits. And the acquiring of good habits is a matter merely of conscious direction of our mental grooves through our wills. In a previous article I described how the mind will not work except in response to a stimulus from without. No stimulus can be more potent than a conscious effort to direct our habits, a process that psychology has reduced to rule. The following maxims cover the ground thoroughly, and may be applied either in the formation of new habits or in breaking habits already formed.

Begin the task of acquiring or breaking a habit with all the strength and determination you possess.

Never relapse into your old habits, even when you are certain that the new habits are ingrained in you—have become second nature.

Respond instantly to every inward prompting toward actions that tend to aid the formation of the habits you seek to acquire.

Stimulate your habit of effort by performing every day at least one difficult task not connected with the habits you are forming.

As a single, all-embracing principle in the formation of habits, an eminent psychologist lays down this rule:

"Make automatic and habitual, as early as possible, as many useful actions as you can."

In "The Story of the Mind" next month, Doctor Walsh will explain the science of our emotions—what they are and how to use them for profit.

WINDOW SIGNS



AGENTS 500% PROFIT
Genuine Gold Leaf Letters
GUARANTEED TO NEVER TARNISH



For store fronts, office windows, bank windows, office doors, panels, board signs, trucks, automobiles and buses. Signs of all kinds. Anyone can put them on and make money right from the start without previous experience.

All you have to do is to show your samples, the letters are very attractive and easy to sell. Letters cost ng 31-c each for 25c. One agent says: "Your Letters are the best thing I have seen in years. I have made \$125.00 the first week and still going strong." Paul Clark says: "Smallest pay \$28.70." St. Gilder made \$835.00 in six weeks.

\$60 to \$200 a Week

GENERAL AGENTS— It is easy to acquire sub-agents for this line. We pay you 20% cash commission on all orders we receive from local agents appointed by you anywhere. We allow you 50% discount on your own orders. You can sell to nearby trade or travel all over the country as you please. Large demand for window lettering everywhere. Write today for free sample, full particulars and liberal offer to general agents.

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Wear the Brooks Appliance, the modern scientific invention which gives complete relief to the sufferer. It has no obnoxious springs or pads. Automatic Air Cushions bind and draw together the broken parts. No surgery or plaster. Don't let the doctor tell you that to prove its worth. Beware of imitations. Look for trade-mark bearing portrait and signature of C. E. Brooks which appears on every Appliance. Name other genuine. Full information and booklet sent free in plain, sealed envelope.

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MASTER CEMENT WORKER OF THE WORLD
Los Angeles, Calif.

Here Are the Correct Answers to Questions on Page 58

1. Experiments have shown that the air temperature that is best for brain work, for the white race, is about 65 degrees.

2. In dry weather the surface of the flower becomes tough and the pores close up so that the odoriferous oils cannot get out. After a rain the pores are open and the perfume is more noticeable.

3. No. Criminal tendencies are not indicated surely by anything in the features. The contrary theory was held and defended by the great Italian criminologist, Lombroso, but his views have not stood the test of time and are no longer held.

4. Nearly all storms in the United States move across the continent along the same path. They start in the northern part of the Pacific Ocean, swing southeast across the Western States and then northeast from the Mississippi Valley across the Eastern States into the Atlantic. The weather map shows the path of such a storm and makes it easy to predict the approximate time it will reach a certain place.

5. During your first attack of a disease, the body makes chemicals and some of them remain inside the body. If one of the same kind of germs ever gets in again, the chemicals quickly poison it off.

6. All through the air, even when it is purest, there are many millions of tiny particles of matter. Some are specks of dust, some are water particles, some are the molecules of air itself. All of them are far too small for us to see, but they reflect a little light. This reflected light is of a bluish color.

7. We know of none. Anything done by ancient workmen can be duplicated or improved by modern methods, provided one is willing to take enough trouble.

8. Electricity passes along the nerves. If it is strong enough, it paralyzes the nerves, among them, those that control breathing.

9. In marshes and swampy places, wood and other vegetable matter that become buried in the mud decay and form certain easily inflammable gases. Bubbles of these gases sometimes come to the surface and catch fire when they touch the air. This is supposed to be one cause of the flickering lights called the will-o'-the-wisp. Another may be the living bacteria that produce light much as the fireflies do.

10. Distill it; that is, make steam of it and then condense this steam back into water again. The salt thus is separated from the water.

11. The South American boa constrictor, also called the anaconda or python. Several species of snakes that differ scientifically are included under these common names. Some are 20 feet long.

12. Usually the colors are due to very small amounts of impurities that happen to get mixed in with the mineral crystal while it is forming. For instance, white sapphires, blue sapphires, rubies, and emery powder are all composed of exactly the same material—oxid of aluminum. The white sapphires are nearly pure. The blue ones and the rubies contain very small amounts of certain colored impurities. Emery contains such large amounts of impurities that it is black and opaque.



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Columbia Dry Batteries are sold by electrical, hardware and auto accessory shops, marine supply dealers, implement dealers, garages, general stores. Insist on Columbias. Fahnestock Spring Clip Binding Posts on Columbia Ignitor at no extra cost.

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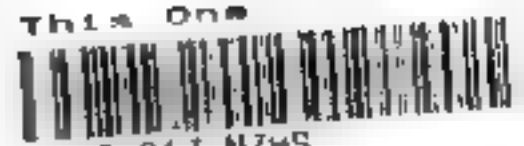
Columbia Dry Batteries

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5732-01J-NZHS



E·D·Elliott of Milford, N.Y. establishes a *record*

Think of getting London, England, Fairbanks, Alaska and La Palma, Panama, when you live in New York! Yet this is the experience of Mr. Elliott, one of the hundreds of enthusiastic users of MIRACO sets. With the inexpensive outfit shown here, priced at only \$29.50, he received the following list of stations—results that would do credit to a set costing three or four times as much.

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FWY	Havana, Cuba	WBAK	Harrisburg	WOR	Newark, N.J.
CPAC	Calgary, Can.	WOC	Davenport	WLAS	Louisville, Ky.
CUY	Calgary, Can.	WPAP	Winchester, Ky.	WEAB	Orange, La.
KEL	San Francisco, Cal.	WMAK	Beaumont, Tex.	WED	Chillicothe, Ga.
KDPT	San Diego, Cal.	WWE	New York	WUO	Washington, D.C.
KHO	Seattle, Wash.	WBY	New York	EMO	Tacoma, Wash.
WZAR	Providence, R.I.	WGL	Philadelphia, Pa.	KOS	New Mexico
KFB	Lorain, Wm.	WMAF	Dartmouth, Mass.	WDAK	Philadelphia, Pa.
WV	Houston, Tex.	WBAQ	Dartmouth, Mass.	WFI	Philadelphia, Pa.
WMAT	Dubuque, Iowa	WBAQ	Dartmouth, Mass.	WIP	Philadelphia, Pa.
WPM	Washington	WHAP	Dartmouth, Mass.	KDKA	Pittsburgh, Pa.
WRAA	Houston, Tex.	WHN	Hidewood	WJAE	Pittsburgh, Pa.
WHD	Kansas, Neb.	WIAK	Camden, N.Y.	KMN	Little Rock, Ark.
KFIB	Hood River, Ore.	WGP	Fort Smith, Ark.	WEE	Hood River, Ore.
CPCA	Toronto, Canada	WDAK	Harrisburg	WHAZ	Troy, N.Y.
CKCB	Toronto, Canada	WDAK	Harrisburg	WGH	Buffalo, N.Y.
CJCI	St. John, Can.	WDAK	Harrisburg	WMAV	Auburn, Ala.
WRP	Dallas, Tex.	WDAK	Harrisburg	KFDD	Idaho
NOE	Missi, Minn.	WDAK	Harrisburg	WNAE	Omaha, Neb.
KGA	Oakland, Cal.	WDAK	Harrisburg	WCAP	Washington, D.C.
KFL	Denver, Col.	WDAK	Harrisburg	WQAB	Springfield, Mo.
WIAZ	Missi, Minn.	WDAK	Harrisburg	WFB	St. Louis, Mo.
WKY	Oklahoma City	WDAK	Harrisburg	WDR	Detroit, Mich.
WDAE	Tampa, Fla.	WDAK	Harrisburg	WNAE	Boston, Mass.
WBB	St. Louis	WDAK	Harrisburg	WHAZ	Columbus, Ohio
WRE	Hamilton	WDAK	Harrisburg	CFEC	Montreal, Que.
WHAZ	Galesburg, Tex.	WDAK	Harrisburg	WMAK	Lockport, N.Y.
6ZY	Salt Lake City	WDAK	Harrisburg	WGP	Des Moines, Ia.
NAA	Arlington, Va.	WDAK	Harrisburg	WHAM	Harrisburg, Pa.
WJAX	Cleveland, Ohio	WDAK	Harrisburg	WGM	Vicksburg, Miss.
WBE	Hartford, Conn.	WDAK	Harrisburg	WGAY	Madison, Wis.
WOO	Philadelphia, Pa.	WDAK	Harrisburg	WVI	Des Moines, Mich.
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WOK	Pine Bluff, Ark.	WDAK	Harrisburg	WWAJ	Columbus, Ohio
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Oliver gives much better heat—steady and even for baking, broiling, frying or boiling—all at the turn of a valve. Better, cheaper, quicker.



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**Cheaper than coal or
wood**

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**Fits all stoves—any
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letters like these. Mrs. W. N. Spencer, of Connecticut, writes: "The Oliver works like magic. It is wonderful to have quick heat and no work." Mr. Elijah McCleave, of Virginia, says: "It works fine. All my friends want one. I will get their orders." A letter from Mr. S. K. Pedro, of South Carolina, says: "Beats all other burners seen in this county. A sensation." Mr. Geo. Flynn, of Michigan, writes: "It is cleaner, cheaper, hotter and steadier than coal or wood. Only cost me \$5.00 for two months."

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Now, once and for all, do away with household dirt and drudgery. End ashes, dirt, smoke, odor, chopping, shoveling, carrying dirty, heavy coal and wood. The Oliver in your stove, heater or furnace saves hours of work. Send immediately for the free attractive booklet, "New Kind of Heat," telling all about this amazing new invention. Shows exactly how it works, how it is different from all other burners, how it will relieve you of the back-breaking work of coal and wood fires. And if you send immediately you will be in time to get a Special Low Introductory Price Mr. Oliver is now making to the readers of this magazine. Even if you do not buy now you should not miss the opportunity to become entitled to this low price should you wish to buy later, by writing at once.

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FOR months we've been shipping up to 10,000 and 12,000 Parker pens a day. We could sell more if we could make them—indeed demand seems boundless. But Duofold craftsmanship cannot be turned on in any quantity like water.

Every Iridium tip, for example, is skillfully fused in the extra thick gold point by hand. Then it's polished to a jewel-like smoothness, and this is slow—for this tip is the hardest metal known.

Five times every point is inspected by experts. And each pen is filled with ink and written with, before the final O. K.

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sweepings. Recently, here, one rubbish heap yielded us \$2500 in gold.

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No pen is a genuine Duofold unless stamped—"Geo. S. Parker—DUOFOLD—Lucky Curve." Look carefully.

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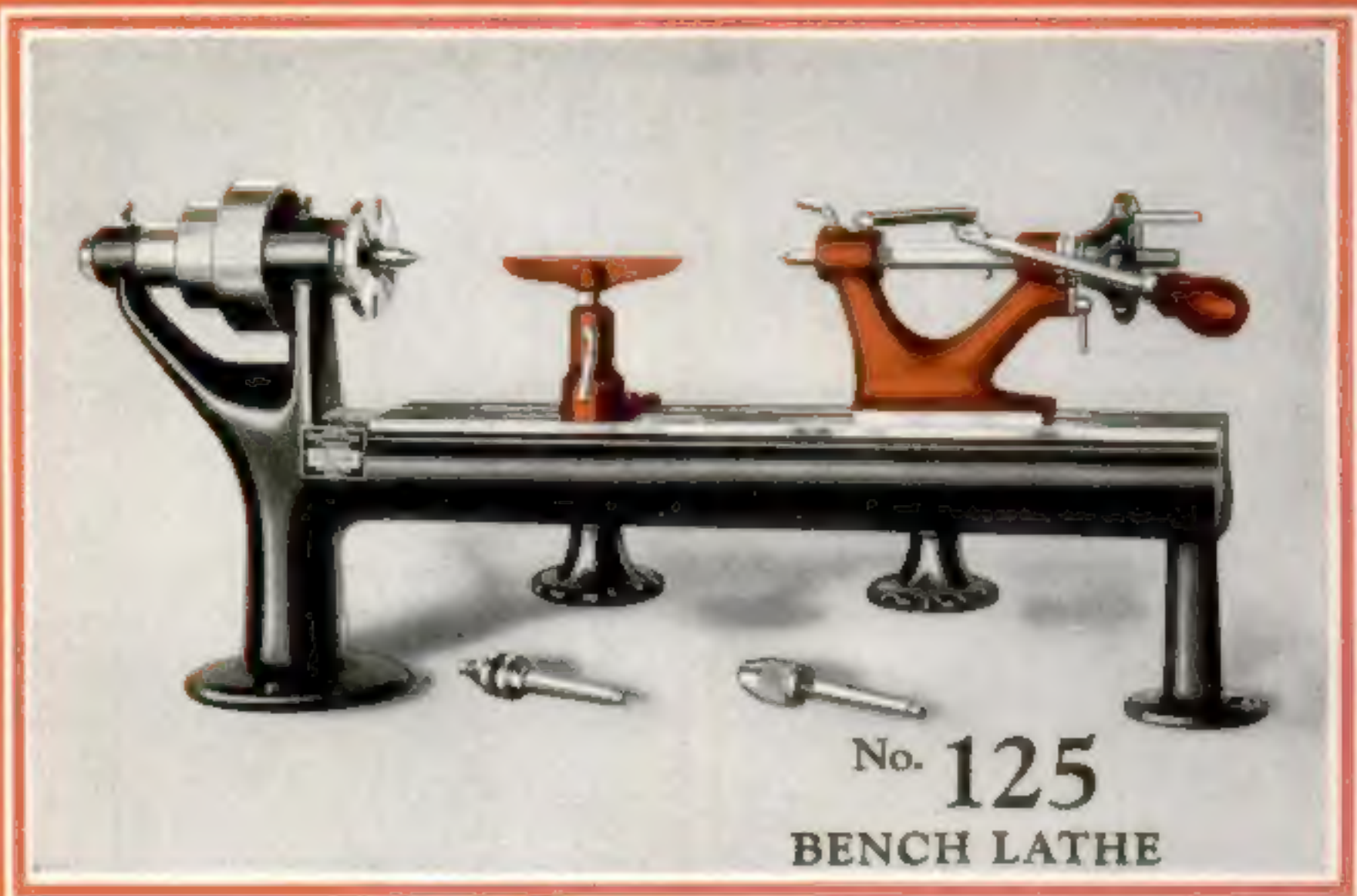
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